The Mediterranean from 50 000 to 25 000 BP

Turning Points and New Directions

Edited by

Marta Camps and **Carolyn Szmidt**

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Foreword

Derek A. Roe

Emeritus Professor of Palaeolithic Archaeology
University of Oxford, UK

The passage between the periods which we call Middle and Upper Palaeolithic has long held a special fascination for Palaeolithic archaeologists, but over the past ten years or so it has gone right to the top of the list of 'hot' research topics. There are many reasons for this, matching the fact that the process of transition can be, and indeed needs to be, studied from many different archaeological and anthropological angles. In every one of the fields of research that are now involved, there have been important methodological and technological advances: obvious examples are the great refinement of dating methods and the revelation that DNA can be recovered from hominid fossils. Underpinning it all is genuine and apparently enduring public interest in what actually happened at this point in human history, which means, on the one hand, a better-than-usual chance of obtaining research funding and, on the other, an outpouring of publications, both technical and popular, as work proceeds.

Why so much public interest? Well, it's ourselves, isn't it? Bright, clever, intelligent modern humans – they don't call us *Homo sapiens* for nothing – replacing those tiresome and deeply flawed, even if quite charming, Neanderthals. Modern behaviours, artistic flowering, population explosion, economic revolution, start of everything good, all happening at once – *you* know. Well, probably. Or possibly. Well, maybe not. Let those archaeologists and physical anthropologists find out and tell us. And that, of course, is where the troubles begin, and it is also why books like this one, and meetings like the one that provided its origin, will continue to be needed. I think it is fair to say that we are now far more aware than ever before of the complexity of the processes that together constitute this particular transition, and we have also learned that some of the factors may have to be followed much further back in time, and over a wider geographical area than we had previously believed, but general agreement on what actually happened, where and when, has remained elusive – indeed, some might feel that it is further from our reach now than it was, say, fifty years ago.

My own interest in these events has remained that of a teacher, by which I mean that I was never personally involved with research concerning them. But because the passage from Middle to Upper Palaeolithic, however it took place, is undoubtedly a key event in the whole human story, I wanted to be able to give students as clear an idea as possible of what was involved in it and what may have been the dynamic forces at work. This task first confronted me in the middle

1960s, and was very different then from what it had become when I retired from teaching in 2003, though some points may seem surprisingly familiar.

The principal battle-ground in those days was southwest France, and the sequence of well-known stage names represented at the classic cave sites there. In particular, La Ferrassie and Laugerie Haute between them offered a basic succession from Mousterian to Magdalenian, although one really needed to fill it out it a bit by looking at a few other sites. It was a matter of deciding in the first place what in the sequence was 'local development' here in southwest France and what was 'intrusive', and then trying to work out what 'intrusive' might imply. Was François Bordes, who had carried forward work begun by Denis Peyrony, right to keep up his passionate defence of an unbroken local Perigordian sequence, with its roots in the final stages of his beloved southwest French Mousterian and indeed ultimately in certain evolved Acheulian industries from which he believed the Mousterian had sprung ? If so, this implied an entirely local progression from Middle Palaeolithic to Upper, and the Aurignacian was just a temporary intrusion from somewhere further East, which in due course the local population outlasted or absorbed. It was true that there was little relevant hominid fossil evidence in France to document the passage from archaic to modern humans, which had evidently taken place at the same time, but Bordes had no doubt that it would before long be forthcoming. Or should we put our faith in Dorothy Garrod, Hallam Movius and others, who preferred to call Bordes' Lower Perigordian 'Chatelperronian' and his Upper Perigordian 'Gravettian' and to recognise a chronological hiatus between them, which the Aurignacian filled? This view left the nature and indeed the authorship of the Chatelperronian episode as an open question, but it clearly linked the Gravettian to technologically and typologically similar Upper Palaeolithic industries further East, and implied that the Middle to Upper Palaeolithic transition in France was achieved by incoming peoples, specifically the Aurignacians, and consolidated by their Gravettian successors.

Whichever view one took, it was already possible, and indeed necessary, to ask other important questions, though not everyone did so. It was a matter of common consent that if new people had entered southwest France, they would have done so from an easterly direction, since there seemed to be no credible sources lying north, west or south. So, how did the observed sequence in France relate to events in the Near East, and in particular to the long sequence in the Mount Carmel caves, where the same Dorothy Garrod had documented another episode of transition from Middle to Upper Palaeolithic, and where one of the caves, Skhul, had yielded hominid fossils that some thought were themselves in a 'transitional' stage between archaic and modern? It must be remembered that their true age was not yet known and the importance of Qafzeh was still unrecognised Though southwest France and the Near East were far apart, there was one undeniable common link between the two areas: the very distinctive Aurignacian, regarded by all as fully Upper Palaeolithic and certainly the work of *H. sapiens*. Since everyone allowed that the Aurignacian was intrusive in France, was it not the most rational explanation that it had originated in the Near East and spread westwards through Europe (since it was absent in North Africa) to France? Knowledge of the Aurignacian in Central Europe was sketchy, however, and there were few reliable dates for it anywhere – conventional radiocarbon dating was still at a relatively early stage, and accelerator dating undreamed of. One difficulty was that the earliest of the radiocarbon dates seemed to be in central Europe, rather than the Middle East, but hey, don't worry too much about that: everyone says that there are problems with radiocarbon dates as early as that, so let's only believe the ones that support our own particular views.

Note too that there was little mention of sub-Saharan Africa at this time: it was seen as a backward area, with little or nothing in common with the classic Upper Palaeolithic sequence of Europe, and any transition from the Middle Stone Age, with its flake industries, to the Late Stone Age, with blades, must be late by European standards. The simple reason for this was a profound lack of dating evidence, and a misunderstanding of the few dates that did exist: few now remember that, at the time of which I am writing, the whole of the southern African MSA was perceived as being more or less contemporary with the Upper Palaeolithic of Europe, while the LSA was thought to begin not many millennia before the end of the Pleistocene. Accordingly, there was really nothing to suggest that sub-Saharan Africa had played any significant role in the origins either of anatomically modern humans or of the patterns of technology or behaviour that in Europe seem to appear in the Early Upper Palaeolithic.

How vastly all that was to change over the next four decades. If I were to chronicle properly and discuss the major discoveries and changes in approach that have brought us to where we now are, this would cease to be a Foreword and would risk becoming the longest chapter in the book. Amongst the archaeological highlights were the discovery and dating of many new *Homo sapiens* fossils, in Africa, the Near East and Europe, changing our whole perception of the species and its range in time; a new understanding of the Neanderthals, their early emergence and late survival in certain areas, and their role as a species separate from *H. sapiens*; and the revelation that certain aspects of human material and social culture, previously regarded as classically 'Upper Palaeolithic' in origin, including blade technology, an increase in bone tool manufacture, and the creation of decorative or artistic objects, could in fact be documented much earlier than anyone's wildest dreams, often in sub-Saharan Africa, which emerged as an ever more important source area. Accompanying what might be grouped together as the field discoveries, and making it possible to evaluate their significance properly, were various fundamental changes that were driving Archaeology, including Palaeolithic studies, forward. There were vital and dramatic advances in archaeological science: for students of the Palaeolithic, these included the DNA revolution, the introduction of several new chronometric methods, and remarkable developments in radiocarbon dating itself, making possible not merely readings of far greater accuracy, but also the non-destructive sampling of delicate artefacts, humanly modified animal bones, even hominid bones themselves. It became possible to obtain dates that were undeniably specific to some particular episode of human activity or presence at a given site. There was also the whole impact of computer science and information technology on archaeology and, all the while, advances in Quaternary Research were giving us a greatly expanded timescale in the Middle and Upper Pleistocene, and new light on just how many major and minor oscillations of climate there had been.

Partly independently of all these things, and partly because of the new possibilities they created, there were also changes in the interpretive aims of archaeologists, who progressed, perhaps somewhat helter-skelter and with varying degrees of individual awareness, from being typologists and culture historians to processualism and post-processualism, with the research funding in hot pursuit, once events in the modern world economy had rather suddenly made everything unreasonably expensive. The twentieth century gave way to the twenty first, and so, here we are, with our discipline older and wiser and technically equipped as never before to examine any problem or test any hypothesis in minute detail. So, why don't we know all the answers about how our remote ancestors got themselves from the Middle to the Upper Palaeolithic? Actually achieving it does not seem to have caused them too much trouble – unless you count the demise of the Neanderthals, but that seems to have been incidental and perhaps inevitable anyhow – and perhaps we should reflect that the terms 'Middle Palaeolithic' and 'Upper Palaeolithic' are entirely of our own making, and are labels assigned with hindsight. Their origin lies in the attempts of 19th and early 20th century students of the past to break up the vastness of the Palaeolithic period into more manageable units for their own convenience, regardless of the essential continuity of history and of prehistory before it. Once the terms were adopted, the need for an understandable 'transition' was likely to be felt by scholars who had only relatively recently accepted the notion of evolution. Perhaps we are still expecting to find rather more precise answers than are waiting to be discovered. Curiously enough, after all the field discoveries, the technical advances and the changes in the interests and motivation of the researchers, the actual research task remains the same: to discover what happened, where and when.

Shall we ever achieve that, and if so, how? We still need more sites, more dates, more hominids, more archaeological assemblages – and we need them in more geographical areas than we had previously thought. We need perhaps greater awareness of the limitations of the archaeological evidence: when objects occur together in a layer, there may be many different ways in which they have come into what seems to us to be direct association. That they were all made and deposited by the same people in a single episode of occupation is only one of the possibilities. The same goes for the finding of hominid remains in a level which contains artefacts and occupation traces: must it always be the case that we are looking at the remains of the makers of the tools? We surely need also to retain flexibility in our reading of any situation, and a willingness to revise our individual views, rather than defend them at all costs. The rather drastic redating of several sites and hominids over the past decade or so should have taught us that kind of caution: anyone's overview of the transition at the present time must count as a working hypothesis rather than a final answer. If some of the present researchers look back on the mid-twentieth century as the bad old days, a time when various dominant figures in the academic world, satisfied that their own views were exclusively correct, simply brushed aside or even ignored alternative suggestions, they should perhaps just check with particular care that nothing like that is happening today. Surely not – it couldn't be, could it? We're too clever and open-minded for that. On the other hand, perhaps it was a part of the original transition to modern human behaviour, to prefer defeat of opponents to cooperation: these extended social networks are all very well, but only if one feels free to ignore them, and surely the best use of enhanced linguistic skills is to tell everyone else they are wrong. As for detached observers and writers of Forewords, they are just Nature's Neanderthals, doomed to suffer the same fate – whatever that was. At least I resisted the temptation to write 'Nature' in italics.

While the foregoing comments reflect my own opinions, similar thinking on at least some of the points will be encountered by readers of the chapters that follow. Turning to the present volume: the editors were kind enough to send me copies of all the individual contributions, except a few late arrivals, and I enjoyed reading them. It is not my role to preview them in detail individually, but to introduce them generally. It was an interesting and refreshing idea to take the countries bordering the Mediterranean as the geographical region, and the result is that, even more than usual, one has the sense of trying to fit together the pieces of a jigsaw puzzle. Not infrequently, in these chapters, the arguments about the transition still return to what happened in southwest France, but as we turn the pages we are able to see that classic area in its proper context, and we can begin to understand the role of other parts of Europe, and of various regions beyond.

Iberia, the concern of several authors here, has become very important, yielding sites, hominid fossils and dates which are highly relevant to several key aspects of this whole transition phase in Western Europe. These include the idea of relatively late Neanderthal survival in certain refuge areas, the date of the earliest appearance of fully Upper Palaeolithic industries, and the likelihood of a substantial period of overlap between archaic and modern human populations. The present stage of research in Iberia seems to be one of lively debate rather than general agreement, and there's nothing wrong with that. It is good to see some informative contributions, some offering broad coverage and others dealing with specific topics, on the other major European peninsulas that extend southwards into the Mediterranean, with the Adriatic between them: Italy, where the nature and role of the Uluzzian has been rather seldom discussed in the past, and is of great interest, and the Balkans, where finds are perhaps unexpectedly sparse. Both these areas must have offered conditions broadly comparable to those of southern Iberia, and a comparative study of the three sets of archaeological evidence should have much to tell us. Romania, while not strictly a country bordering the Mediterranean, is a very relevant area, and one of great interest, with far more sites and material than I had ever realised: intensive research is needed there, and should be productive.

Turkey is a large region, and its geographical position east of the Balkans and north of the Levant is crucial for this volume: not only does it have many sites of its own, still not widely known, but also, very important actual or potential migration routes pass through it. The Levant has a far longer history of intensive research, and several outstanding sites are located there: our reading of the archaeological sequence has changed greatly over the years. This region is an outpost of the Neanderthals, who must have made their way there from Europe, but it is also a place which modern humans, coming from the opposite direction, had reached by at least 100,000 years ago. Did the two populations ever meet? How long did they actually share the territory? It is a place where we see early *Homo sapiens* remains associated with artefacts of Middle Palaeolithic character, something that should no longer surprise us, if we accept that the cultural background of these people was the Middle Stone Age of central and southern Africa. The Levant is also the southern limit of Aurignacian distribution, but quite separately it is the home of a very different and locally developed Early Upper Palaeolithic tradition, the Ahmarian. Plainly, many of the jigsaw-puzzle pieces belong to the eastern margin of the Mediterranean, but can we fit them together?

As regards the southern coastline of the Mediterranean and its hinterland, three fascinating contributions in this volume between them cover Egypt and North Africa. They draw our attention not only to what is present, but to what is not, and we see very clearly how conditions of extreme aridity determined where humans could and could not survive, for extended periods of time. This is the only Aurignacian-free region in all the area covered by this volume; it also seems fair to conclude that there was minimal contact, if any at all, during the whole Transition period, between the scattered and often struggling population of North Africa and any other part of the Mediterranean basin. The exception might be Lower Egypt, and possibly eastern Libya, where one could perhaps argue that there were links for a while via Sinai to the southernmost Levant. Had climatic and environmental circumstances been entirely different, the Straits of Gibraltar might have offered an important linking route between northwest Africa and southwest Europe, and there might even have been movement of people in both directions, but it really does seem that this can be ruled out. It is important to note that Late Middle Palaeolithic people ranged widely, even if in small numbers, over most of North Africa, as long as conditions allowed, making the very interesting Aterian industries, and they seem to have been early *Homo sapiens*, broadly comparable to the humans of Skhul and Quazeh, with their cultural roots in the MSA somewhere south of the Sahara.

This book is a highly informative progress report on research concerning the passage from Middle to Upper Palaeolithic, and I found it full of valuable information and comment. It does not claim to offer final solutions, and it confines itself to its chosen area, which is fair enough. Some of the authors refer in passing to other key regions, for example, the Danube Valley and Central Europe, or sub-Saharan Africa, but it is for other volumes to bring us up to date in detail with what has been happening there. As one would expect, widely differing views are put forward with equal confidence here on some of the key issues, perhaps most strikingly in the case of the nature and significance of the Aurignacian: in two contributions, the latter is the main theme, and most of the other authors need to refer to it or discuss it quite fully. Those Aurignacians seem to get everywhere, in the chosen region, apart from North Africa, turning up sooner or later, in large numbers or small, challenging us to explain them. You can choose if you wish between arguments that the Aurignacian originated in the Levantine Near East at an early date and spread massively into Europe, or that in the Levant it is merely a relatively late and brief intrusion, which affected only the north of the region and was not particularly influential. One has the feeling that these two views cannot both be correct. At least there is wider consensus in principle that what has been called ‘the Aurignacian’ in the past is really a composite phenomenon, with at the very least an earlier and a classic form.

Having earlier urged researchers to maintain flexibility, a stance which might occasionally involve admitting ignorance, I am very happy to point the way by saying that I have never felt that I know about the Aurignacian, and it is not for lack of reading the literature. To me it has always seemed highly distinctive in its artefacts – not just in possessing forms like the split-based bone points and the nosed and carinated scrapers, but in its whole tradition of polyhedric burins, including some specialised forms, in the elegant semi-invasive style of retouch on the large ‘Aurignacian blades’, in the delicate fluting of many ordinary end-of-blade scrapers, and in the remarkable absence of the abrupt retouching of blades that was the basis of design in many components of the succeeding Gravettian stone tool kit. It is true that many of the tools are made on flakes rather than blades, but for many Aurignacian tools a chunky blank rather than a flat one was precisely what was required. I wish I could see clearly, amidst the various suggestions that have been made here and elsewhere, just where and from what base this very striking tradition of toolmaking emerged. And who were the people? I wish we had altogether clearer associations of hominid remains for the Aurignacian, especially its beginning. I’m even prepared to wonder why we don’t: what did they do with their dead, and why? Yes, I still really don’t know about the Aurignacian, and I think that if I did, I would understand much more clearly the nature of the passage from Middle to Upper Palaeolithic in the lands around the Mediterranean.

Do not be put off by the Foreword writer’s ignorance. This is a book of contributions that need to be read carefully and in full, even in days where there seems so little time to read books. The Editors are to be congratulated on their production, and it would be sad if people followed the growing habit of citing the papers in their own future publications, having read no more than the abstract and conclusions.

Introduction

Marta Camps and Carolyn Szmidt

The aim of this book is to address the Middle to Upper Palaeolithic transition in the broad Mediterranean region, through the examination of the nature and extent of behavioural changes and differences that took place from 50 000 to 25 000 BP. This book is the first to draw together research from the entire Mediterranean littoral, *i.e.*, Europe, North Africa and the Near East, and on differing theoretical perspectives on the topic of the Middle-Upper Palaeolithic transition, to compare and discuss results from the various areas. It is a geographical area that has a strikingly varied archaeological record during this period, which seems to differ somewhat from those of neighbouring, more inland, regions, thus meriting closer examination. The Mediterranean region has been the source of much discussion and debate, especially in recent years, as one of the hypothesised migration routes of *Homo sapiens* across continents. Its importance was noted early on through the work of researchers such as A. Broglio, G. Laplace and A. Palma di Cesnola, to name but a few scholars, who observed specific and unique aspects of its record already half a century ago. One of these issues is that it provides us with a glimpse at possible contact between the continents of Africa, Asia and Europe during this critical period and enables us to compare the archaeological signatures of two human species in closely-situated regions at a given moment in time.

This book emerged from a Symposium entitled “The Mediterranean from 50,000 to 25,000 BP: Turning points and new directions” that we organised and which took place at the Society for American Archaeology (SAA) Conference in Salt Lake City, Utah, USA, on March 31, 2005. The idea for it began earlier, however. As both of us have been working in this field for a number of years, the idea of organising a session on the transition period of the Mediterranean zone, where we both work, had been on our minds for a while. It was at the SAA Conference in Montreal in 2004, though, that we first sat down to brainstorm seriously about its planning.

In particular, as organisers and editors, we were keen to include analyses that adopted a regional-scale approach and outlook, those which integrated multiple data types/lines of evidence and/or those which addressed methodological or theoretical issues of importance to this period and to the Mediterranean region as such. We wanted to ensure that both theoretically/methodologically-based as well as site-based papers were included, whether their authors saw a sharp transition or more of a mosaic pattern and continuity.

In an attempt to bring together archaeologists who do research in various parts of the Mediterranean littoral but who do not necessarily have the opportunity to meet, compare and discuss results of the various areas of the Mediterranean, we chose to organise, in addition to the half-day Symposium, a two-hour discussion session after the symposium as well as a Roundtable Luncheon. One of the essential aspects to come out of the latter two meetings was discussion over what should constitute an Aurignacian attribution and over the definition of the Aurignacian, which was very clearly felt needed more fine-tuning.

From Symposium to Book Volume

From the beginning, we were interested in publishing the papers as a volume and met with Oxbow Books prior to the conference to outline our plans and discuss the idea. Their immediate acceptance at that initial meeting in Oxford, and their active interest throughout have been invaluable.

The book then emerged and expanded from that Symposium as a number of additional researchers joined the project at the stage of the book, thus widening the scope and perspectives. We chose to implement a double-blind refereeing process for all articles, including our own; that is, the authors did not know who had refereed their article, but also, the name(s) and other identifying marks of the author(s) were deleted before sending the paper to referees. This was greatly appreciated by many of our authors and we hope that such a practice will become the trend in the future.

The manuscript, in its various stages, has travelled and been worked on across continents and in various countries, including Canada, England, France, Spain and the USA where either or both of us were at one moment or another in this volume's production between teaching, fieldwork and other research activities of ours. Like the small, transportable, lightweight artefact which is the bladelet, our lightweight, efficient, transportable technology was the flash drive, which allowed us to work on the manuscript, in all its stages, anywhere we were. In addition, the process was greatly sped up by the fact that we were able to meet up on a number of occasions.

Organisation of the book

We have organised the papers into three groups, beginning with more historically and methodologically-focused papers, then going through regional ones in geographic order around the Mediterranean, from western North Africa to the Near East, then through southern Europe westward to the Iberian Peninsula. We end with two more theoretically-oriented, and contrasting, papers which examine the issues on a larger, pan-European scale, and in particular, the definition and origin of the Aurignacian.

Themes running through the papers

Through the papers, and to varying extent, authors summarise and re-assess past work in their region of interest for the late Middle Palaeolithic/Middle Stone Age and/or the early Upper Palaeolithic/Later Stone Age, assess current research strategies through the presentation of latest results and current knowledge and propose and discuss guidelines for the future, in different ways. Many of the aspects which are identified as currently lacking or problematic in a region will serve as good avenues for future directions of research to pursue. It is not our goal to summarise the papers, since all of them provide abstracts that will guide the reader about the contents of each chapter, but we wish to outline below a few of the key themes running through them, to give a general idea about the whole volume.

Some main lines of questioning addressed include, for instance: What, if any, archaeological changes take place from the late Middle Palaeolithic/Middle Stone Age to the early Upper Palaeolithic/Later Stone Age in specific Mediterranean regions? Are they marked differences or not? How might these relate to social, demographic, ecological or other factors? What is the variability within each industry and is the variability too great for each to be considered one unit? This, in turn, relates to identifying precisely the defining characteristics of each industry. What is the origin of the various early Upper Palaeolithic/Later Stone Age industries and what is their relationship to each other? What is the timing of the transition and how does this relate to the nature, timing and routes of dispersal of *Homo sapiens*, if at all? The degree to which typological systematics have helped or hindered us in our characterisation of these industries is also an issue of importance to this region and beyond. It is clear that the Palaeolithic period, whose research tradition has been so long, must take into account historiographical aspects, such as changing definitions and practices, into account. Hence, more theoretical perspectives can also be found in this book, and they focus on the interpretation of the ways in which several scholars have approached the phenomenon of the transition as well as each and every facet of this debate, from typological systematics to the interpretation of human behaviour, and the way in which this debate has developed along the thirty-odd years during which it has been one of the most controversial topics in Palaeolithic research.

The extent of the chronological overlap of industries and the identification of their makers are issues of critical importance to resolving the extent of possible interaction and influence between Neanderthals and modern humans. Although the attribution of the Mousterian to Neanderthals seems virtually unquestionable in Europe, it is certainly not unquestionable in the Near East, where *Homo sapiens* are also associated with the Middle Palaeolithic, and it is definitely not the case in North Africa where there were no Neanderthals. Thus, although in some ways the Mediterranean can be seen as a unit sharing certain archaeological characteristics during this period, the examination of a larger geographical region than is usually done makes one that much more aware of the extent to which there can be variability even between adjacent regions. The hominin attribution of the early Upper Palaeolithic in Europe is very tenuous as there are very few fossils associated with these industries and many of the ones thought to be associated have recently been shown not to be Upper Palaeolithic in age. Thus, let us remain cautious about archaeological-anthropological links and thus, by extension, the nature and degree of influence and acculturation.

It is clear that establishing an accurate and precise chronological framework is of prime importance in all the regions. The presentation of new dates, the questioning of previously obtained dates and the impact of chronometric dating in this period, including the effect of calibration, are addressed by many authors. Even if contemporaneity of similarity is established, though, one is still left to deal with the *cause* of this, and thus with the task of separating ‘influence/

acculturation/diffusion' from 'convergence'.

The uneven geographical distribution of sites and the emptiness of certain regions at certain times are discussed by some authors as well as whether these are due to real lack of settlement or lack of research. The role that the environmental conditions may have played in the feasibility of occupation, as well as the possibility and preference for geographic expansion, is addressed as part of this, highlighting the importance of precisely correlating proxy data to the archaeological record.

For the European record, to what extent Neanderthals (as seen primarily through the Mousterian, but also some other non-Aurignacian assemblages) were already incorporating a lot of the changes supposedly associated with modern human behaviour, is addressed by a number of papers, whether it be raw material transport, the organisation of living space, subsistence strategies, choice in site location, use of bone, antler, ivory or personal decoration.

Many papers examine a region from a multi-site perspective. Doing this kind of work, in which results of many sites, excavated at various times under differing paradigms need to be brought together, entails addressing important and unique methodological aspects not necessarily needed in research based on one's modern excavation of single sites. These include aspects such as whether lack of sites or artefact types may be related to research priorities and/or excavation practices rather than to past hominin behavioural practices. As comparative research increases, given the large-scale continental and inter-continental-scale questions that are increasingly being addressed, and as the reliance on previously-excavated collections augments, assessing the latter and integrating criteria in data selection to ensure maximum reliability and comparability are going to become progressively more imperative.

The archaeological record from southern Europe, the Near East and North Africa are each usually dealt with separately in conference sessions and publications, possibly due to differing systematics and research traditions. Due to this, it is difficult to compare these regions. The Mediterranean unit is the one region where the three converge and attempts to search for links, whether technological, geographic, or other, between these macro-regions are made by some of the authors here. Recent technologically-oriented research has highlighted the fact that typological systematics can hide technological variability and similarity between seemingly different groups. Such technological research should allow us to characterise better the industries and determine the extent of possible similarities and influence even between industries whose artefact names are quite different and which have been analysed by differing traditions, and typological systematics. It is by taking a wider, yet circumscribed, geographical focus that the value of this becomes that much more evident. It allows us to compare more directly, and neutrally, assemblages from even very differing regions through the comparison of production *processes* rather than finalised products. Hence, comparisons between the early Upper Palaeolithic lithic industries of these three regions and between them and the Middle Palaeolithic record of these regions should become far more feasible in the near future. Such comparisons relate, in turn, to investigating the extent, nature and directions of influence, if any, and to identifying core zones and migration routes.

We believe that this volume will be of interest to a very varied group of readers:

it can be used as a starting point for young scholars, students and researchers looking into the topic for the first time, or in a general way, to get a clear idea of what is the ‘big deal’ all about, as some papers included here aim to provide this overview perspective so that the transition debate can be considered as a whole. The book also provides an in-depth perspective on the Middle-Upper Palaeolithic Transition in all the areas surrounding the Mediterranean basin and related regions, further inland, which have not received that much attention in the past. Even for those who are not directly working in parts of the region as such, this is clear evidence that macro-regional studies of this sort provide us with an incredibly rich and innovative perspective from which we all, and our research, benefit.

Acknowledgments

We are extremely grateful to the twelve researchers who served as referees for this book. As we were covering such a wide geographical region and a wide variety of data types, we felt it necessary to have many referees so that articles could be reviewed by researchers appropriate to the article's themes. What is particularly unfortunate about the blind aspect of the process, however, is that we cannot thank them publicly. You know who you are and we take this opportunity to express to you how grateful we are for your time, careful reading of manuscripts, enriching comments and speediness. We hope that you are pleased with the outcome.

We are very fortunate that the final book includes authors from twelve countries, representing all career stages and a variety of work environments, including universities, research centres and museums. We feel that this diversity of experience, background and points of view benefits everyone. We thank the thirty-eight authors very much for their valuable participation, and for helping us see this book through all its stages to the end.

David Brown and Clare Litt at Oxbow Books were on board and encouraging from the initial contact in November 2004 when we presented them with the idea. We also wish to thank Oxbow Books for doing the layout of the text and figures and thus turning a manuscript into a professional-looking book. We are grateful to Dan Cole (GIS Coordinator, Smithsonian Institution) for providing us with the map that we used on the cover of the book. It is part of the much larger NASA Goddard Space Flight Center Image, Blue Marble Collection, available at http://visibleearth.nasa.gov/. We extend a big thank you to Sassan Sanei, who designed and did the layout of the cover of the book.

At the time when the symposium took place, Marta was an Assistant Research Professor and a Postdoctoral fellow of the Excellence Program at The George Washington University's Department of Anthropology, and was working as well at the Human Origins Laboratory of the National Museum of Natural History (Smithsonian Institution), in Washington D.C. She wishes to thank Professor Alison Brooks for her initial guidance and support during the preparation of the symposium and the early editing stages of the book. Marta worked on the later stages of the editorial process of the manuscript while funded by an Excellence Program grant from the Center for the Study of Advanced Hominid Paleobiology, and she is very grateful to Professor Bernard Wood for his encouragement and assistance during that stage of work. Last but not least, she thanks her boss, Dr. Dave Hunt and all her colleagues at the Aleš Hrdlička Osteology Laboratory, Anthropology Department, National Museum of Natural History (Smithsonian Institution), for their continuous support and friendship throughout these years.

The conference and the work on the book largely took place while Carolyn was a

Postdoctoral Research Fellow in the Department of Anthropology at the University of Toronto, Canada, funded by a Social Sciences and Humanities Research Council of Canada (SSHRC) Postdoctoral Fellowship. It was then completed while a Fellow of the IsoTrace Laboratory, the Canadian Centre for Accelerator Mass Spectrometry and as an affiliated member of the Archaeology Centre, University of Toronto. Carolyn would like to extend her deep gratitude to these centres for providing an intellectual and physical environment which is very conducive to research. In particular, she would like to thank her colleagues, Professor Michael Chazan (Director, Archaeology Centre) and his group of Palaeolithic researchers, of which she is a part, as well as her colleagues at the IsoTrace Laboratory, especially Professors Roelf Beukens, Liam Kieser and Ted Litherland, for their unfailing encouragement in this endeavour and other Palaeolithic ones in which she is involved.

List of Contributors

Alvaro Arrizabalaga received a BA in History (Vitoria, 1988) and a Masters in CRM -Archaeology option- (Vitoria, 1992) at the University of the Basque Country (Spain). He finished his Ph.D. in Prehistory (*La industria lítica del Paleolítico superior inicial en el oriente cantábrico*) in 1995. He has been a lecturer of Prehistory at The University of the Basque Country since 1995. His archaeological fieldwork has focused on the excavation of Palaeolithic sites, such as Labeko Koba, Lezetxiki and Irikaitz, in The Iberian Basque Country. His research related publications include several articles and contributions to different scientific meetings. His main interests are human cultural and symbolic behaviour at the Middle to Upper Palaeolithic Transition.

Anna Belfer-Cohen is a professor at the Hebrew University of Jerusalem, exploring cultural 'beginnings' in the Levantine prehistoric record, *e.g.*, the appearance, nature and evolvement of Upper Palaeolithic entities, considered as representing modern *Homo sapiens*. Her present field project involves the study of the Georgian Upper Palaeolithic sequence in order to see the similarities and differences with the Levantine one. Concurrently, she is involved, among others, in studying the Natufian phenomena, Levantine complex hunter-gatherers who became sedentary, bridging the Palaeolithic and the Neolithic realms.

Federico Bernaldo de Quirós PhD at the Universidad Complutense de Madrid in 1978. (*Los inicios del Paleolítico superior en la Región Cantábrica*). He has worked in many Cantabrian sites, such as Cueva Chufin (Solutrean), Salitre and Cueva de la Pila (Azilian-Magdalenian). In 1984, he became Director of the Centro de Investigaciones y Museo de Altamira. In 1989 he was transferred to the Universidad de León where he still works. His interest is centred on the behavioural activities of paleolithic groups, both economic and technological, and also artistic. From 1980, he was responsible for excavations at the El Castillo site with V. Cabrera. He is a member of the UISPP and other scientific societies.

Bonnie Blackwell is a graduate of McMaster University and the University of Alberta (Canada). For the past 17 years, she has been conducting ESR analyses to date Paleolithic archaeological sites as well as Quaternary and Pliocene paleoanthropological and paleontological sites. In addition to Divje Babe I (Slovenia), she has published ESR dates for La Chaise-de-Vouthon, Roc de Marsal, and Pradayrol (France), Isampur, Hathnora, Devni-Khadri, and Attirampakkam (India), Tsaga'an Agui (Mongolia), Obi-Rakmat (Uzbekistan), Sterkfontein and Swartkrans (South Africa), and Olduvai Gorge (Tanzania). She currently co-directs the RFK Science Research Institute and works as a research scientist with Williams College.

Joel Blickstein graduated from City University of NY (USA) in 1995. In 1994, he joined Dr. Blackwell to found the RFK Science Research Institute, which he continues to co-direct. The RFK Institute trains underprivileged NYC students in geology and archaeology by having them learn to do ESR dating. In addition to the Divje Babe I (Slovenia) dating project, he has helped to mentor students in developing new applications for ESR dating including freshwater molluscs, crocodylian and kangaroo teeth, and coupled ESR-U/Th dating for corals, and in applying geochemical analyses to problems of U and Fe uptake into fossil teeth.

François Bon, born in 1970, received his Ph.D. from the Université de Paris I – Panthéon-

Sorbonne (France) and then became Senior lecturer at the Université de Toulouse-Le Mirail, where he has been teaching Palaeolithic archaeology since 2001. His research, developed within UTAH (UMR 5608) of the French C.N.R.S., relates to the advent of the Upper Palaeolithic in Western Europe, the ethnoarchaeology of Southern Africa and the History of Prehistory. He is the author of scientific contributions relating to the Upper Palaeolithic and, in particular, Aurignacian of Western Europe. He takes part in several field projects in France (particularly Brassempouy and Régismont-le-Haut) and in South Africa.

Jean-Guillaume Bordes received his Ph.D. from the Université Bordeaux 1, where he has been, since 2004, a Senior lecturer in the PACEA Laboratory, UMR 5199 of the CNRS. He is a specialist in lithic industries of the Middle to Upper Palaeolithic transition, in particular those of the Aurignacian. His research has been focused primarily in the region of Southwstern France (Directing the excavations at Caminade from 1999 to 2001; at Le Piage since 2003), but also in the Balkans (Bacho-Kiro) and in Iran (Yafteh; field assignment of the Ministry of Foreign Affairs in Iran (directed by J. Jaubert)).

Marta Camps is a Postdoctoral Scholar in the Anthropology Department at The George Washington University (Washington D.C.). Having graduated from the Universitat de Barcelona, she obtained an M.Phil. at the University of Cambridge and a D.Phil. from the University of Oxford. She is a specialist in the Mid-Upper Paleolithic Transition in SW Europe, and her research focuses on that, dispersal routes and epistemology/methodology in typological systematics. She is the Vice-President of the "Transitions in the Paleolithic" UISPP commission, and a researcher in the project to date the Mid-Upper Paleolithic Transition using ultrafiltration AMS ^{14}C (University of Oxford). She is also based at the Osteology Laboratory of the NMNH (Smithsonian Institution).

Geoffrey A. Clark, archaeologist and paleo anthropologist, is the author, co-author or editor of over 250 articles, notes and comments, and 10 monographs and books on human biological and cultural evolution in 'deep time' – the past four million years. A University of Chicago Ph.D. (1971), his current interests turn on the logic of inference in the various aspects of modern human origins research. Clark is a Regents' Professor in the School of Human Evolution & Social Change (SHESC) at Arizona State University, in Tempe, Arizona.

Angela E. Close is a Professor of Anthropology at the University of Washington. She was educated at Cambridge University and received a Ph.D. in archaeology in 1975. She has conducted research in North Africa from Algeria to Sinai, but primarily in mainland Egypt. Her interests lie in the Stone Age – Lower Palaeolithic to Neolithic – and in the analysis of flaked stone, particularly in the ways in which it can inform us about past societies. Most recently, she has taken the skills she developed in North Africa and applied them to the Pacific Northwest of North America.

Laura Eizenberg is a Ph.D student at the University of Toulouse Le Mirail (France), under the direction of Pr. M. Barbaza and Dr. F. Bon. She works on the processes leading up to the emergence of the Upper Paleolithic. The main goal of this study is to assess the unity and the variability of an initial stage of the Upper Paleolithic, integrating lithic industries of the so-called Protoaurignacian of Western Europe and the Early Ahmarian of the Near-East.

Elena A.A. Garcea (Ph.D., Universita' di Roma "La Sapienza", Italy, 1991) is Researcher in Prehistory at the University of Cassino, Italy, where she teaches 'Prehistory' and 'Methods of Archaeological Research'. She has been, and still is, in charge of archaeological research projects in Libya and Sudan. Her research interests include the spread of modern humans in the Sahara and the Maghreb during the Upper Pleistocene and the last hunter-gatherers in the Upper Nile Valley and the Sahara during the Early Holocene. She is author of *Uan Tabu in the Settlement History of the Libyan Sahara*.

Nigel Goring-Morris is a professor at the Hebrew University of Jerusalem. His research has focused on investigating the shift in adaptations from mobile foraging band societies to settled village communities subsisting on domesticated plants and animals. To this end he has conducted extensive field and laboratory projects on various aspects of the Upper Palaeolithic, Epipalaeolithic and Neolithic periods in the various ecological zones of the Levant. In addition to studying lithic technology, he is also interested in spatial studies and settlement patterns. Lately he is directing long-term investigations at a Pre-Pottery Neolithic mortuary and cult site of Kfar HaHoresh near Nazareth.

Ildiko Horvath is a Doctoral candidate in the Department of Anthropology at McGill University, Montreal, Canada. She holds an Honours B.A. in Anthropology (1997) and a M.Sc. in Archaeology (1999) from the University of Toronto. Her current research is on the early Upper Paleolithic of northeastern Romania. She is working on the analysis of the collection of artifacts recovered from major sites in the area, doing primarily technological studies and use-wear research. She has participated in field excavations in Romania and the Czech Republic. She has published on European Paleolithic archaeology, zooarchaeology, North American and Near Eastern archaeology in Canada, USA, Romania and Hungary.

María-José Iriarte received a BA in History (Vitoria, 1985) and a DEA (*Aportación de la Palinología al conocimiento del Paisaje Vegetal del Würm en la Cornisa Cantábrica*) in Prehistory (Vitoria, 1986) at the University of the Basque Country (Spain). She finished her Ph.D. in Archaeobotany (*El Paisaje Vegetal de la Prehistoria reciente en el Alto valle del Ebro y sus estribaciones atlánticas: datos polínicos, antropización del paisaje y primeros estadios de la economía productora*) in 1994. Her research related publications include numerous articles and contributions to different scientific meetings. She has also been involved in archaeological excavations. Her main interests are Archaeobotany (in the field of Palynology) and the reconstruction of Quaternary environments and human impact on the vegetal landscape.

Ivor Karavanić is Associate Professor and Head of the Department of Archaeology, Faculty of Humanities and Social Sciences, at the University of Zagreb. Born in Zagreb, Croatia, in 1965, he received a B.A. in 1990, M.A. in 1993 and Ph.D. in 1999, all in Archaeology, from the University of Zagreb. He teaches Paleolithic Archaeology at the same University, conducts research on the Mousterian site of Mujina Pećina and directs the scientific project 'Flint in the Stone Age of Croatia' sponsored by the Ministry of Sciences, Education and Sports of the Republic of Croatia. He received a Fellowship from the French Government in 1995 and 2001, a Constantin-Jireček Fellowship in 1995, a Fulbright Predoctoral Research Fellowship in 1996, a National Geographic Society Grant (with Fred H. Smith) in 2001, and was Visiting Professor at the Institut de Paléontologie Humaine, Muséum National d'Histoire Naturelle, Paris, during March, 1996.

Beverly Lau performed the first dates on Divje Babe I while still a student with the RFK Science Research Institute. She later obtained a B.A. from State University of New York at Binghamton and currently lives in NYC.

Foni Le Brun-Ricalens (b. 1965) is Curator of the Department of Prehistory at the National Museum of History and Art (G.-D. of Luxembourg) since 1994 and permanent member of the International Union for Prehistoric and Protohistoric Sciences. Since 1986, he has directed several excavations of western European Stone Age sites (Palaeolithic, Neolithic) in Luxembourg and France. As a specialist in Aurignacian lithic technology, he conducts and collaborates on a number of international fieldwork projects aimed at helping to con tribute to clarifying the Middle to Upper Palaeolithic Transition in Eurasia. He is currently focusing in particular on an epistemological re-questioning of the criteria used to characterise the Upper Palaeolithic technocomplexes and their significance. He is the Director of the scientific series, '*ArchéoLogiques*'.

José-Manuel Maíllo (Madrid, 1973) received a BA in Geography and History (Madrid, 1996) and finished his Ph.D. in Prehistory: *La Transición Paleolítico Medio-Superior en Cantabria. Análisis tecnológico de la industria lítica de Cueva Morín*, in 2003 (UNED, Madrid). Since then, has been a member of the Department of Prehistory and Archaeology at the

UNED, as a researcher and, at present, as Assistant Professor. His research is focused on lithic technology at the Middle to Upper Palaeolithic Transition and he digs at sites such as El Castillo and Cueva Morín.

Paul Mellars has been Professor of Prehistory and Human Evolution at the University of Cambridge since 1997. He took his BA and Ph.D. in Archaeology at Cambridge, and then taught for ten years at the University of Sheffield. He is best known for his work on the European Mousterian and for studies of the origins and dispersal of modern humans, leading to his publication of "The Neanderthal Legacy" (1996) and the earlier conference volumes on "The Human Revolution" (1989) and "The Emergence of Modern Humans" (1990). His recent publications have focused mainly on the impact of radiocarbon calibration studies for the dispersal of modern humans across Europe, and the integration of the archaeological and DNA evidence for modern human origins and dispersal from Africa, recently published in Nature, Science, PNAS and Evolutionary Anthropology. He has also conducted and published excavations on the Mesolithic sites of Oronsay and Star Carr in Britain.

Alexandra Miller is a MA candidate at the Department of Anthropology of Arizona State University, and her main interest is the computer analysis of technological developments in lithic tool production in the late Middle and Early Upper Palaeolithic in Europe.

Fabio Negrino holds a Ph.D. in prehistoric archaeology from the Università di Roma "La Sapienza" and is currently affiliated with the University of Pisa. His research focuses on the Paleolithic cultures of northern Italy (especially the Middle-Upper Paleolithic transition), with a focus on technological analysis and raw material provenience studies. From 2002 to 2005, he was co-director of excavations at the Middle and Upper Paleolithic site of Riparo Bombrini (Liguria, Italy). Beyond several chapters in edited volumes, he has published papers in the *Journal of Archaeological Science*, *Geoarchaeology*, *Preistoria Alpina*, *Préhistoire du Sud-Ouest*, and the *Bulletino di Paletnologia Italiana*.

Christian Normand is an archaeologist in the Service Régional de l'Archéologie d'Aquitaine (Ministère de la Culture) and a member of the UTAH (UMR 5608) of the Université de Toulouse-Le Mirail (France). He is specialized in the techno- and typological analysis of lithic assemblages, as well as in lithic raw materials' catchment areas. He has carried out many field projects in prehistoric sites from the northern slope of the Western Pyrenees and he has published several papers about them. Since 2000, he is the Director of the research team that works in the cave of Isturitz, a key site for the understanding of the Middle to Upper Palaeolithic Transition and the development of the Aurignacian in South-western Europe.

Marcel Otte is Professor of Prehistory at the Service of Prehistory, University of Liège, Belgium. His interests include the European Upper Paleolithic, origins of the Aurignacian and modern humans in Eurasia, the processes leading to the Aurignacian and expansion of the Aurignacian via diffusion of ideas and/or population movement.

Dimitra Papagianni, M.Phil. (University of Cambridge), Ph.D. (University of Cambridge) is a research fellow at the Centre for the Archaeology of Human Origins, University of Southampton. Her current research interests include landscape use, site distribution patterns and mobility patters, long-term behavioural change in hunter-gatherer societies, the Middle and Early Upper Palaeolithic in Europe, Palaeolithic and Neolithic lithic technologies, Palaeolithic open-air sites, survey methodologies in Palaeolithic archaeology and the Palaeolithic of southeastern Europe. Dimitra has undertaken surface surveys and excavations in Greece, Croatia, Romania, Cyprus and Israel.

Ana C. Pinto Llona is a research scientist in the Department of Prehistory (Institute of History, Spanish National Research Council CSIC) in Madrid, as well as the discoverer of the Sopeña shelter and PI and fieldwork and research coordinator of the Sopeña Archaeological Project. She defended her MA at the Universidad de Barcelona (1995), Ph.D. at the Universidad de Oviedo (2001) and postdoc at the Institute of Human Origins (ASU, USA, 2002–2003). Her main interest is the study of the origins of modern human behaviour, through taphonomic (biostratinomy) characterization of human/carnivore fossil assemblages, analyses of human-produced bone surface modification, research on fossil diet by dental microwear analyses and others.

Kaye E. Reed is an Associate Professor in the Department of Anthropology of Arizona State University. Her main interest is the analysis of ecomorphological data in relation to the earliest stages of human evolution. She defended her MA in Anthropology at Stony Brook (1993) and her Ph.D. at the State University of NY at Stony Brook in 1996.

Julien Riel-Salvatore holds a Ph.D. in anthropology (prehistoric archaeology) from the School of Human Evolution and Social Change, Arizona State University. His research focuses on the Uluzzian transitional industry of southern Italy, and the Middle-Upper Paleolithic transition in Italy and Eurasia as a whole. His methodological interests include lithic technoeconomy and prehistoric land-use and mobility, topics which he approaches from a theoretical perspective grounded in human behavioral ecology and niche construction theory. He has published papers in *American Antiquity, Current Anthropology, Antiquity* and *Munibe*, as well as in a number of edited volumes.

Derek Roe studied Archaeology & Anthropology as an undergraduate and doctoral research student at Cambridge University in the late 1950s and early 1960s. His subsequent career was based entirely at Oxford University, where he became University Lecturer in Prehistoric Archaeology in 1965, and retired as Professor of Palaeolithic Archaeology in 2003. He directed the Donald Baden-Powell Quaternary Research Centre from 1975 till retirement, and has been a Fellow of St Cross College since 1970. His main research concerned the earlier Palaeolithic in Britain, sub-Saharan Africa, the Near East and Continental Europe, with stone artefacts a particular interest, but his teaching covered the whole Palaeolithic period.

Dragomir Skaberne is a geologist based in Ljubljana (Slovenia). At the request of Ivan Turk, he has analyzed sediment samples from Divje Babe I. He has co-authored several papers with Turk's team discussing aspects of sedimentary deposits at Divje Babe I.

Anne Skinner is a graduate of Radcliffe College and Yale University (USA). For more than 40 years, she has studied ESR systems. Most recently, she has lent her considerable experience to directing the ESR dating lab at Williams College, where she is a Senior Research Fellow. Under her leadership, the lab has partnered with the RFK Science Research Institute for 13 years to train and mentor young scientists learn how to perform ESR analyses to date Paleolithic archaeological sites as well as Quaternary and Pliocene paleoanthropological and paleontological sites. Hers is the only ESR dating lab in the USA.

Carolyn Szmidt is a Fellow of the IsoTrace Laboratory, the Canadian Centre for Accelerator Mass Spectrometry, and is affiliated with the Archaeology Centre, University of Toronto. Previously, she was a Postdoctoral Research Fellow in Archaeology in the Department of Anthropology at the University of Toronto, having received her Ph.D. from the University of Cambridge (England). Her research interests and publications within Palaeolithic archaeology concern the Middle and early Upper Palaeolithic periods, radiometric dating, regional-scale analysis and methodological issues in multi-site, comparative analysis. She is the Director of a multi-site, Wenner-Gren Foundation-funded, radiocarbon dating project in the larger southern France region aimed at the Middle to Upper Palaeolithic transition, among other radiocarbon projects. She is a member of the international scientific research teams of a number of Palaeolithic sites in the South of France.

Ivan Turk studied archaeology in Ljubljana (Slovenia). Since 1968, he has participated many test and systematic excavations within Slovenian caves with Quaternary Palaeolithic deposits. From 1989–1999, he directed and excavated the Palaeolithic site at Divje babe I. He currently works as a research scientist with the Institute of Archaeology in Ljubljana. His main interest remains the methodological approach to archaeological research and the role of natural sciences in interpreting Palaeolithic sites. He has published several papers on this topic in *Arheološki vestnik* and two volumes in the *Opera Instituti Archaeologici* (Viktorjev spodmol and Divje babe I) monograph series.

Janez Turk a son of Ivan Turk, studied geology in Ljubljana. At his father's suggestion, he participated excavations at Divje babe I. There, he studied sediments to understand their paleoclimatic features. He is now writing his dissertation on karst hydrology at Karst Research Institute in Postojna, Slovenia.

Pierre M. Vermeersch (b. 1938) is emeritus professor of the Department of Geography and Geology at the *Katholieke Universiteit Leuven*, Belgium. He was head of the Laboratory for Prehistory and of the Belgian Middle Egypt Prehistoric Project. He did field work in Upper Egypt and in the Red Sea area from 1965 until 2003. The field work was oriented towards finding new Palaeolithic sites, excavating them and understanding their significance within a framework of environmental conditions and human adaptations. He is author and editor of several books on the Egyptian prehistory. He is also active in the West European Stone Age.

Işın Yalçınkaya is Professor of Archaeology at Dil ve tarih – Coğrafya Fakültesi, Prehistorya anabilim dale, Sihhihe-Ankara, Turkey. Her interests include the Paleolithic of Anatolia, particularly the Middle Paleolithic. She has been director of excavations at Karain and Öküzini since the 1980s.

Edwin Yu began to work on the ESR dating project while still a student with the RFK Science Research Institute. Since then, he has gone on to train as a civil engineer at Polytechnic University in Brooklyn, where he is currently completing his M.Eng.

João Zilhão is Professor of Paleolithic Archaeology at the University of Bristol. In 1995–97, he directed the scientific research and the Archaeological Park setup and management work in the Côa Valley, and prepared the nomination of its open air Paleolithic rock art for UNESCO's World Heritage status (listed December 1998). In 1998–99, he directed the excavation of the Lagar Velho child burial and, in 2004–2005, the archeological work inside the Oase karstic system. In recognition of his contributions to European Prehistory, he received a Research Award from the Humboldt Foundation (2003) and the Europa Prize of the London Prehistoric Society (2005).

Contributors' Addresses

Alvaro Arrizabalaga
Grupo de Investigación Consolidado y de Alto
Rendimiento en Prehistoria de la Universidad del País
Vasco (9/UPV 155.130–14570/2002)
Facultad de Filología y Geografía-Historia
C/ Tomás y Valiente s/n
01006 Vitoria
Spain

Anna Belfer-Cohen
Department of Prehistory
Institute of Archaeology
Hebrew University
Jerusalem 91905
Israel
belferac@mscc.huji.ac.il

Federico Bernaldo de Quirós
Área de Prehistoria
Facultad de Filosofia y Letras
Universidad de Leon
Campus de Vegazana
24071 León
Spain

Bonnie A. B. Blackwell
Department of Chemistry
Williams College
75–40 Parsons Blvd.
Williamstown, MA, 01267
USA
bonnie.a.b.blackwell@williams.edu

Joel I. B. Blickstein
Department of Chemistry
Williams College
75–40 Parsons Blvd.
Williamstown, MA, 01267
USA
joel.b.blickstein@williams.edu

François Bon
UTAH – UMR 5608
Maison de la Recherche
Université de Toulouse – le Mirail
5, Allées A.-Machado
31058 Toulouse Cedex 1

France

Jean-Guillaume Bordes
IPGQ-PACEA-UMR 5199 du CNRS
Avenue des facultés
Université Bordeaux 1
F-33405 Talence cedex
France
jg.bordes@ipgq.u-bordeaux1.fr

Marta Camps
Department of Anthropology
Center for the Advanced Study of Human Paleobiology
The George Washington University
2110 G Street, NW
Washington, DC 20052
USA
mcamps@gwu.edu

Geoffrey A. Clark
Department of Anthropology
Arizona State University
Tempe, Arizona 85287–2402
USA

Angela E. Close
Department of Anthropology
Denny Hall M32
University of Washington
Seattle, Washington 98195–3100
USA
aeclose@u.washington.edu

Laura Eizenberg
University of Toulouse Le Mirail, UMR 5608 – TRACES
5, allées Antonio Machado
31058 Toulouse – cedex 9
France
lauraeizen@hotmail.com

Elena A. A. Garcea
Dipartimento di Filologia e Storia
Universita’ di Cassino
Via Zamosch 43
03043 Cassino, FR
Italy
egarcea@fastwebnet.it

A. Nigel Goring-Morris
Department of Prehistory
Institute of Archaeology
Hebrew University
Jerusalem 91905
Israel
goring@mscc.hujiac.il

Ildiko Horvath
Department of Anthropology

McGill University
Stephen Leacock Building
855 Sherbrooke Street West
Montreal, Quebec, H3A 2T7
Canada
ildiko.horvath@mail.mcgill.ca

María-José Iriarte
Grupo de Investigación Consolidado y de Alto
Rendimiento en Prehistoria de la Universidad del País
Vasco (9/UPV 155.130–14570/2002)
Facultad de Filología y Geografía-Historia
C/ Tomás y Valiente s/n
01006 Vitoria
Spain

Ivor Karavanić
Department of Archaeology
Faculty of Humanities and Social Sciences
University of Zagreb
Ivana Lučića 3
HR-10000 Zagreb
Croatia
ikaravan@ffzg.hr

Foni Le Brun-Ricalens
Département d’Archéologie Préhistorique
Centre de Recherches Archéologiques
Musée National d’Histoire et d’Art
241, rue de Luxembourg
L-8077 Bertrange
Luxembourg
Foni.Le-Brun@mnha.etat.lu

Beverly Lau
R.F.K. Science Research Institute
75–40 Parsons Blvd.
Flushing, NY, 11366
USA

José-Manuel Maíllo
Departamento de Prehistoria y Arqueología
Universidad Nacional de Educación a Distancia (UNED)
C/Senda del Rey, 7
28040 Madrid
Spain

Paul A. Mellars
Department of Archaeology
University of Cambridge
Downing Street
Cambridge CB2 3DZ
England
pam59@cam.ac.uk

Alexandra Miller
Department of Anthropology
Arizona State University

Tempe, Arizona 85287–2402
USA

Fabio Negrino
Dipartimento di Scienze Archeologiche
Università di Pisa
Via Santa Maria 53 – 56126, Pisa
Italy
E-mail: archeoge@tin.it

Christian Normand
Service Régional de l'Archéologie d'Aquitaine
Centre Archéologique Départemental
54 rue Francis Jammes
64240 Hasparren – Pyrénées Atlantiques
France

Marcel Otte
Service of Prehistory
University of Liège
7, place du XX août
Bâtiment A1
B-4000 Liège
Belgium

Dimitra Papagianni
Centre for the Archaeology of Human Origins
Archaeology, School of Humanities
University of Southampton
Avenue Campus, Highfield
Southampton, SO17 1BJ
United Kingdom

Ana C. Pinto-Llona
Instituto de Historia
Dept. Prehistoria CSIC
c/ Duque Medinaceli 8
28014 Madrid
Spain
acpinto@ih.csic.es

Kaye Reed
Institute of Human Origins
Arizona State University
Tempe Arizona 85287–2402
USA

Julien Riel-Salvatore
Department of Anthropology
Arizona State University
Tempe, Arizona
85287–2402
USA

Derek A. Roe
St Cross College
University of Oxford
Oxford OX1 3LZ

England
derek.roe@prm.ox.ac.uk

Dragomir Skaberne
Geološki zavod Slovenije,
SI-1000, Llubljana,
Dimičeva 14,
Slovenia

Anne R. Skinner
Department of Chemistry,
Williams College,
75–40 Parsons Blvd.,
Williamstown, MA, 01267,
USA
anne.r.skinner@williams.edu

Carolyn Szmidt
Archaeology Centre
University of Toronto
19 Russell Street
Toronto Ontario M5S 2S2
Canada

Ivan Turk
Inštitut za arheologijo
Znanstvenoraziskovalnegacentra
(SAZU, Slovenian Academy of Sciences)
SI-1000, Llubljana, Novi trg 2
Slovenia

Janez Turk
Inštitut za raziskov krasa,
Znanstvenoraziskovalnega centra
(SAZU, Slovenian Academy of Sciences and Arts),
SI-6230, Postojna, Titov trg 2
Slovenia

Pierre M. Vermeersch
Geo-instituut
Celestijnenlaan 200E
B-3001 Heverlee
Belgium
pierre.vermeersch@geo.kuleuven.be

Işın Yalçinkaya
Department of Prehistory
University of Ankara
Dil ve tarih cografya fakultesi
Prehistorya anabilim dale
T-06100 Sihhihe, Ankara
Turkey
ykaya@humanity.ankara.edu.tr

Edwin S. K. Yu
R.F.K. Science Research Institute
75–40 Parsons Blvd.
Flushing, NY, 11366

USA

João Zilhão
University of Bristol
Department of Archaeology and Anthropology
43 Woodland Road
Bristol BS8 1UU
United Kingdom
Joao.Zilhao@bristol.ac.uk

1. Where there’s a will there’s a way? 30 years of debate on the Mid-Upper Paleolithic transition in western Europe

Marta Camps

Abstract

This paper offers a personal review of the main works on the phenomenon of the Mid-Upper Paleolithic Transition, particularly as studied in Western Europe. A close look into the debate on this process enables the author to suggest reasons why this topic has proved so contentious for so long, and why it looks as if it is here to stay for a few more years at least.

There seems to be sort of a tradition for newly qualified graduates to be overcritical of their seniors and contemporaries, and the author has no wish to do that. Her aim is merely to review past work and the present level of consensus as a basis for looking forward to the continuation of research in what is currently one of the most exciting and active fields of all Paleolithic archaeology, and which was the focus of the conference where this volume originated.

Introduction

Since the study of the numerous questions that form this research topic began, there have been several authors who have provided syntheses, about one aspect or the other. In 1984, Smith and Spencer (p. ix) edited a volume that responded to the ‘need [that] existed for a detailed consideration of the “origin” of anatomically modern … Homo sapiens…’; it now seems worthwhile to provide an overview of how the debate has evolved in the last thirty years or so, and where exactly it stands at present; here, this is done from the archaeological perspective, and taking into account some of the major publications of this period.

The research on the timing, nature, causes and even the actual existence of the Mid-Upper Paleolithic Transition, as a palaeoanthropological process, is just over thirty years old, if we take Mellars’ contribution to Renfrew’s *The Explanation of Culture Change. Models in Prehistory* (Renfrew 1973) as a starting point. During the 1980s, the debate began to be a major subject of discussion in international gatherings and edited volumes, and became interlinked with the study of modern human origins. Then, biological and behavioral changes were considered by many to have happened simultaneously and were accordingly very likely to be closely related, a view that still persists today (*e.g.* Klein 1999, etc.)

It is common to encounter in many of the 1980s and 1990s publications a sense of lack of progress in the study of the Transition (Frayer *et al.* 1994; Soffer 1994;

Willermet and Clark 1995; Freeman 1996; Braüer and Stringer 1997; Clark 1999, etc.), which is widespread, both formally (as mentioned in these and other publications) and informally. This paper aims to look back on this topic of research, to provide the reader with a critical review of the evolution of this subject, and to address the possible causes for its supposed stagnation.

Thirty years on

A critical appraisal of some forty publications shows that what might well have become a really broad debate and perhaps even the most thriving topic in current Paleolithic research has been permanently trapped within two main topics:

- the characteristics of the Transition
- the question on Neanderthal acculturation

Before considering these two major components, it is important to note that although this matter became a focus of study *per se*, the role and the position of Neanderthals in the hominid phylogenetic tree had been a major theme of discussion and disagreement since the discovery of the remains of Feldhofer Cave in 1856 (see Spencer 1984,1–49 for details). The current Mid-Upper Paleolithic Transition debate clearly did not start on a blank slate.

The characteristics of the Transition

The character of the middle-upper palaeolithic transition in south-west France (Mellars 1973) is widely considered as the 'first real synthesis of data [on] the Middle/ Upper Paleolithic Transition' (White 1982). In it, Mellars defined the transitional process as observed in the Périgord as presenting the following characteristics:

- a much wider range and complexity of tool forms [as compared to the Middle Paleolithic].
- ability to shape bone, antler and ivory into complex forms.
- appearance of personal ornaments, defined as 'small objects for which [there is] no obvious functional explanation' (Mellars 1973,259).
- specialized hunting of one species [reindeer].
- larger dimensions of settlements suggesting larger groups.
- modifications of the settlements' natural conditions, thought to indicate a new ability to create a more permanent home-base status than before.
- existence of long-distance contacts, due to extensive seasonal migrations or some sort of trade with far away areas.
- increase in population density.

It took nine years for the next major international paper to appear. *Rethinking the Middle/Upper Paleolithic Transition* (White 1982) was published in Current Anthropology, together with other scholars' views and critical comments. The wide distribution of the journal turned the issue of the Transition into a major international discussion. Although White's paper was intended as a critical review of previous studies, the strict limitation of the analysis to Mellars' 'arbitrarily imposed framework', as Gamble put it, did not lead to the rethinking of anything; on the contrary, this review, which might have been a revision, became the origin of the transformation of those points into generalizations or even into dogma (Gamble 1982,183). White's insight on issues such as personal ornaments is probably his main contribution to the early days of the controversy, but his treatment of aspects relating to lithic technology and typology was rather limited and not pursued at length.

A direct reply from Mellars (1982) followed this article, re-asserting his 1973 tenets, yet these papers failed to elicit major further contributions to the debate, as both he and White had intended, until seven years later, with the publication of the proceedings of the conference 'Origins and Dispersal of Modern Humans', held in Cambridge in 1987 and published in two edited volumes (Mellars and Stringer 1989; Mellars 1990). Only two of its papers are considered here.

Firstly, *Technological Changes across the Middle-Upper Palaeolithic Transition: Economic, Social and Cognitive Perspectives* (Mellars 1989a) was based on three assumptions:

- that biological and cultural changes during the Transition were related.
- that a complex of closely related technological changes took place, mainly: a general shift from flake to blade producing technologies, in the majority of Eurasia, with the exceptions of areas with poor quality raw materials, appearance of well-defined forms of endscrapers and burins and of a range of morphologically new artifacts, highly distinctive and qualitatively different from Middle Paleolithic artifacts, the remarkable speed with which those new artifacts appeared, production of new bone, antler and ivory artifact types, greater standardization and degree of imposed form, producing a clearer pattern of morphological separation between artifact categories.
- that these changes can be identified consistently and repeatedly over large areas of Europe and Western Asia (this is the earliest example where observations from Southwestern France are extended to a continental scale).

In this paper, explanations for technological changes are sought through functional and technological models, and socio-cognitive factors are suggested as the causes of those aspects which cannot be explained by the proposed models. There are no formal explanations for any of the three assumptions on which the whole hypothesis is built; no correlations are made between biological and cultural processes. Other papers presented at the same meeting, quoted to justify the second point, are in fact clearly critical of this hypothesis (see below: Clark and Lindly 1989) and the consistency with which that set of changes can be identified throughout the continent is not considered in any detail, when examining regions outside the core area of the Périgord.

The case for Continuity: Observations on the Biocultural Transition in Europe and Western Asia (Clark and Lindly 1989) calls for the need to pay more attention to the epistemological issues underlying this research. They highlight the role of the application of different typologies in presenting a discontinuous scenario, and scrutinize other points such as the general shift from flakes to blades, which to them is an exaggeration: cases are said to be 'not many' and where they do exist, such shift is only 'slight'; hunting practices are thought to remain unchanged until the Solutrean, clearly against Mellars hypothesis. These authors criticize Mellars and White's papers as a whole, and blame them for concealing variability within the periods (*e.g.* bone technology variability in the Upper Paleolithic), and downplaying similarities between them.

The same year, Mellars' *Major Issues in the Emergence of Modern Humans* in Current Anthropology (Mellars 1989b), approached the changes during the

Transition from the behavioral perspective and related them to the existence of a new human species (*Homo sapiens sapiens*), which had replaced the Neanderthals, particularly in southwestern France. Insistence on better ('more systematic and intensive') subsistence techniques, and more complex social organization, precedes points such as higher population densities and language, assumed because they are understood as necessary for the large regional networks, the aforementioned type of organization and the appearance of symbolism. These three aspects, together with the appearance of complex stone, bone and antler technology are taken as proofs of 'a fundamental transformation of behavior' in Europe. The technological sphere displays a fourfold 'radical shift': standardization (due to specific core preparation techniques), appearance of new tools, more obvious degree of imposed form, and complex bone/antler tools displaying the same characteristics as lithics (standardization and imposed form). The Upper Paleolithic traits of Chatelperronian assemblages are attributed to the Neanderthals' acculturation by those using Aurignacian technology. The latter aspect will be considered in the second part of this paper.

Kozlowski (1990) and Otte (1990) point to symbolic behavior being already present in the Mousterian (personal ornaments). They both delay changes in subsistence practices, raw materials economy and dwelling structures until the Gravettian. Kozlowski proposes continuity from the Mousterian until the Gravettian, via the leaf/backed points industries of North-central and Eastern Europe and Otte sees the origins of the Upper Paleolithic in particular intermediate industries (*e.g.* Couvin cave, Belgium), because, as he says, 'late Middle Paleolithic culture was ready for the evolutionary jump'; he agrees with Mellars, however, that Chatelperronian assemblages are produced by acculturated groups.

The general features supposed to have characterized the Transition 'in Europe' are again the focus of *Cognitive Changes and the Emergence of Modern Humans in Europe* in the first issue of the Cambridge Archaeological Journal (Mellars 1991). Understood as 'broad generalizations, which varied in detail and precise timing', they were then outlined as follows:

- general shift from predominantly 'flake' technology to 'blade' technology [not taking into account earlier claims against the generalized character of this trait (Clark and Lindly 1989)].
- increase in variety, complexity, imposed form and degree of standardization [characteristics still not defined beyond what was said in 1989 (Mellars 1989a)].
- complex bone, antler and ivory artifacts.
- increase in *tempo* of technological change, degree of separation and regional diversification [without mentioning the possible influence of specific typological frameworks which may highlight these characteristics, or the differences in these parameters between the early and late Upper Paleolithic].
- appearance of personal ornaments [contra Otte (1990) and Kozlowski (1990)].
- appearance of complex naturalistic art.
- several socio-economic parameters: systematic hunting (contra Clark and Lindly 1989, Kozlowski 1990, Otte 1990), sharp increase in population density (contra Clark and Lindly 1989), increase in maximum size of social groups, highly structured forms of settlement.

Here the behavioral transition is called 'an explosion in human behavior', during which linguistic and symbolic communication emerge, for which evidence is seen in the artifacts' morphological characteristics (standardization, predetermination and repetition) and the living structures. Since facts about language cannot be proven, the term 'possibility' is quite rightly stressed.

Writing in 1992, Klein ignores this important point and assumes the existence of a developed language system when he attributes the existence of a social relationship network among neighboring groups to fully modern linguistic capabilities, after quoting the points in Mellars' 1991 paper as the ones defining the radical transformation in human behavior which occurred *c.*50–40 kya (Klein 1992). He expresses the belief that knowledge about the Transition will improve as the number of well-dated fossils and sites increases.

Clark's *Continuity or Replacement? Putting Modern Human Origins in an Evolutionary Context* (1992) in Dibble and Mellars' edited volume on the Middle Paleolithic, *The Middle Paleolithic: Adaptation, Behavior, and Variability*, advocates the Continuity hypothesis, favored by many other New World scholars (*e.g.* Wolpoff 1996, etc.), according to which, clinal change can be observed in the following parameters:

- technology
- raw materials procurement and use
- faunal exploitation
- symbolic and ritual behavior
- settlement patterns

This is in line with his previous paper with Lindly in 1989. He also understands the biological and cultural processes as two separated phenomena (contra Mellars 1989a, 1989b, etc.) and warns about the problems which arise when trying to identify local micro-traditions 'on the ground'.

In Cunliffe's 1994 edited volume *The Oxford Illustrated Prehistory of Europe*, the Transition is explained as a European process and the usual tenets are pointed out as behavioral changes in the technological, economic and social spheres, causing the emergence of fully Upper Paleolithic communities. In *The Upper Palaeolithic Revolution* (Mellars 1994) the 'Replacement' hypothesis (also known as 'Out of Africa II') is supported by examples of finds like St. Césaire's Neanderthal remains with Chatelperronian tools (supposedly acculturated), dated to 35 ky BP, and those of Skhul and Qafzeh's modern humans with Mousterian assemblages, dated to 120–90 ky ago (Klein 1999), and the possibility that biological and cultural changes were independent is considered.

Klein (1994) disagrees with this separation in *The Problem of Modern Human Origins*, understanding 'fully modern capacity for culture' as 'the very significant adaptive advantage conferred by fully modern behavior' to be biologically rooted. Against this same author's belief (1992) that more data will mean better knowledge, Willermet and Clark (1995) stress that data have no meaning without a paradigm that defines them, and what is really needed is to stop looking for patterns to establish the credibility of hypotheses and to understand that each side of the debate uses selective evidence (only that which supports a particular hypothesis), and thus the analyses are biased. According to them, while Replacement advocates tend to quote fossils from west Europe, southwest Asia and Africa, Continuity supporters highlight those from central Europe, east Asia and southeast Asia. Clark (2001) states that the need for more data, as advocated by

Klein, is only part of the problem.

In *L'émergence du Paléolithique supérieur en Europe occidentale. Le rôle du Castelperronien*, Rigaud wrote that acculturation had not taken place, because some dates new at the time, proved that techno-economic transformations had occurred prior to the arrival of modern humans, and thus there was no synchronism between biological and cultural changes (Rigaud 1996). Moreover, he states that in Atlantic Europe (which in fact has to be interpreted as Atlantic France) and Italy, human populations had in fact decreased (*contra* Mellars since 1973). Yet in the same UISPP colloquium, with the presentation *Models for the Dispersal of Anatomically Modern Populations across Europe: Theoretical and Archaeological perspectives*, Mellars (1996b) stresses the 'sharp increase in population density and residential group sizes', defining once more the Chatelperronian as a product of acculturation.

'Possible systematic notation' is added to the list of behavioral innovations, and this concept appears in the same author's book, *The Neanderthal Legacy*, which appeared that year (Mellars 1996c), as 'numerical systems or calendars' among the not 'highly discussed' changes (which are not included). The rest of the assumptions and changes remain as quoted above, with the exception of blade technology, mentioned only as 'improved', acknowledging its existence prior to the Transition.

On the basis of the supposed population increase at 40 ky BP, which he still defended, Mellars develops a series of detailed consequences (increase of local residential groupings and of the separation of individual roles, more bounded territorial and demographic units and complex descent and kinship systems) which were presented in his paper to the British Academy (Mellars 1996a). There is no mention of the fact that other scholars had long been questioning such increase in population.

Clark (1997), in *The Middle-Upper Paleolithic Transition in Europe: An American Perspective*, blames the lack of discussion between the two opposed intellectual traditions on the differences between their biases and assumptions; according to him, controversies like the present one 'stem from the failure to consider epistemological questions' in the disciplines involved in it. While this is likely to be true for most of the cases, this section shows that many authors not only fail to consider such factors, but they also constantly omit other scholars' input to the 'debate'.

Clark denies the 'explosive' character of early Upper Paleolithic body ornamentation, and sees an *in situ* gradual development. For him the concepts of imposed form and morphological standardization are 'typological illusions', something which an in-depth analysis of the typological frameworks used to study the lithic assemblages of the Upper Paleolithic should be able to ascertain. Major changes in subsistence, bone technology and art, hunting strategies and settlement patterns are clear to him as occurring only after *c.*20 ky BP, and not 20,000 years earlier, as already stressed in 1989, 1991, 1994, etc.

In 1997, in a paper entitled *Scenarios for the Middle to Upper Paleolithic Transition: A European Perspective*, Rigaud supports the absence of demographic increase and lack of major change in hunting strategies during the Chatelperronian and the early Aurignacian, but thinks that greater standardization is indisputable, yet he fails to explain how and where he sees evidence for this trait. He also acknowledges the possible influence of typological systematics on measuring the diversity of Upper Paleolithic forms; however, far from eradicating the aforementioned generalizations, he divides Europe into five different transitional scenarios, which means repeating the same assertions in slightly milder terms.

In two further papers, Clark (1999, 2001) accuses the contributing disciplines of being discovery-driven and of having little concern for the logic of inference underlying 'knowledge claims'. He thinks that no consensus will be reached until researchers understand the importance of the logic of inference and make it explicit.

In his contribution to an edited volume analyzing the Transition, as a discussant on a particular group of papers, Simek (2001) explains in *Discussion: Space and Time* that the problem lies in Mellars' simplistic approach to culture change and the fact that old excavations' data has been included in the analyses. It is worth noting here that while Mellars approach may indeed be simplistic for some, this is a criticism that could perhaps be applied equally to most or all of the researchers mentioned above, since none of them proposed an alternative perspective, as opposed to going along with the current situation, accepting or denying specific parameters outlined and refined by Mellars.

Detached observers might be pardoned for feeling that, over the years, some of the views had perhaps become a little entrenched as noted above, and that even the language of the debate had not notably responded to new field discoveries or to other highly relevant contributions made elsewhere in the world. This 'entrenchment' is something this side of the debate shares with the subsequent one, the analysis of which follows these lines. An important publication to consider as part of the latter's foundations appeared in 1993, edited by Lévêque, Backer and Guilbaud, presenting the findings of Neanderthal remains in association with a Chatelperronian assemblage.

The Question of Neanderthal Acculturation

Many scholars, as noted in the previous section, had already considered the possibility that Neanderthals had manufactured Chatelperronian assemblages after having been in touch with more modern groups producing Aurignacian tools. Yet, it was not until 1998, that this became a main subject of the discussion, after Current Anthropology published *Neanderthal Acculturation in Western Europe?*, an article by d'Errico *et al.* in a supplementary monograph.

This paper did not challenge pre-established and taken-for-granted traditional links between Neanderthals and the Chatelperronian, and anatomically modern humans and the Aurignacian, despite abundant comments stressing important doubts about such equivalences amongst the replies to the paper (see comments by Conard, etc.), but it shook the foundations of arguments in favor of acculturation put forward by White, Otte, Hublin, Mellars, etc. years earlier, by challenging their hypotheses one by one. Whether they succeeded in modifying those authors' views on the topic is something different, but after twenty-five years of running in circles around the concept of the Transition and its characteristics, d'Errico *et al.* (1998) at least forced Paleolithic scholars to pause and consider an improved and bolder version of the hypothesis that considered Chatelperronian as an independent technological and cultural transformation, unrelated to the Aurignacian phenomenon. This is now known as the 'Indigenist' hypothesis.

This paper is a combination of explicit attempts to maximize accuracy (for example by discarding the evidence from Vindija because of what they consider to be major stratigraphic and sedimentological problems) with what some might well regard as a distortion of existing evidence to support their hypothesis that Chatelperronian layers will always underlie Aurignacian ones when found at the same site. They quote the sites of El Pendo (Spain) and Le Piage and Roc-de-Combe (France) as support to such belief, simply claiming that their sequences, with Aurignacian underlying Chatelperronian layers were proved to be stratigraphically disturbed. Other authors have looked into this issue in a much more detailed manner, as shown below.

In 1998, at a conference in Gibraltar, Rigaud stressed the relationship between the MTA Type B and the Chatelperronian industries, originally stated by Bordes (1968), but highlighted that Chatelperronian assemblages overlying Mousterian deposits always tend to have a larger number of Mousterian artifacts. He also concluded that, despite the two being contemporaneous at *c*.37 ky BP, the MTA Type B had appeared earlier (Rigaud 2000, 2001). At a later meeting in Foz Côa (Portugal) that same year, he thoroughly analyzed the controversial stratigraphies of Le Piage and Roc-de-Combe and convincingly concluded that those sequences are highly problematic; quoting from Rigaud's paper presented in the meeting held at Gibraltar in 1998 (2000,29):

> "… the interstratification of the Aurignacian and the Chatelperronian at Le Piage is highly suspect and that the homogeneity and independence of these archaeological horizons should be tested…"
>
> "At Roc-de-Combe … sedimentological phenomena elements might be responsible for the contamination of the archaeological assemblages…"

Mellars defended his adhesion to the Acculturation (or Population Dispersal, PDH) hypothesis by basing the arguments of three papers (Mellars 1999, 2000a, b) on the 'evidence' provided by El Pendo (considered stratigraphically disturbed since 1982 by Hoyos and Laville, a position revisited and reconfirmed in 2001 by Montes and Sanguino), Le Piage and Roc-de-Combe (already mentioned above) and a 'careful' selection of dates, according to Zilhão and d'Errico's comments to his paper in 1999. For him, the Aurignacian appeared first, c.40–38 ky BP and the Chatelperronian only emerged between *c*.36–34 ky BP, as a result of Aurignacian influence on Neanderthal populations. The reader should bear in mind that the aforementioned studies on El Pendo's stratigraphy have not enjoyed the same widespread circulation as other papers mentioned here. Hoyos and Laville's analysis was published (in French) in Zephyrus, an annual journal published by the University of Salamanca (Spain), and Montes and Sanguino's volume is written entirely in Spanish and has had an unfortunately extremely restricted distribution.

In 1999, the supporters of the Indigenist model presented a total of thirty sequences where Chatelperronian underlies Aurignacian 0/I deposits, and three more, from Italy, where Uluzzian precedes Proto-Aurignacian remains. Far from questioning any of these stratigraphic sequences, they plunged directly into a radically critical analysis of the Spanish and Pyrenean sites that have yielded the earliest dates for the Aurignacian: Reclau Viver's oldest Aurignacian is classified as a palimpsest of Aurignacian and Chatelperronian, l'Arbreda is discarded because of bioturbation and cave bear denning episodes, Abric Romaní's earliest Upper Paleolithic is defined as a palimpsest of Aurignacian and Gravettian composition and level 18 of El Castillo is said to contain a mixture of Aurignacian and Mousterian or Chatelperronian (Zilhão and d'Errico 1999). They also discarded El Pendo, Le Piage and Roc de Combe.

The present author's research (2003) produced data which would support the exclusion of some of the aforementioned sites from a thorough analysis of the Transition in the region; however, Zilhão and d'Errico were severely criticized by many Spanish researchers who feel they should perhaps have at least visited the sites or studied the assemblages of the levels they consider problematic in person (*e.g.* Cabrera Valdés *et al.* 2000), before taking such a decision and publishing it.

In fairness to these researchers, it must be highlighted that they opted to draw comparisons only among dates obtained by the same method, and in the case of ^{14}C, they differentiated from those taken from bone and those obtained from charcoal samples. In four sites, ^{14}C dates on bone present Chatelperronian at *c.*38 ky BP or older, and the earliest Aurignacian is obtained from charcoal samples at *c.*36–37 ky BP. Hublin (2000) points to the fact that with standard deviations usually between 600 and 1000 years, overlapping of those dates is more than likely.

The Indigenists failed to explain why Neanderthals from below the so-called Ebro Frontier, championed by one of them (see Zilhão 1993, 1997), remained excluded from processes undergone by the rest of Neanderthal groups in contact with Aurignacian moderns, since there is no evidence for Chatelperronian remains south of the Ebro. Nevertheless, a rather strange idea is starting to be associated with that frontier: as of late, it is invoked as an example of long term coexistence between the two species, when the concept (though lacking supportive evidence) was originally revamped to express a separation between both species (Zilhão 1993, 1997, Zilhão and d'Errico 1999). In 1998, a team working in the region of Lapedo (Portugal) discovered what they said were the remains of a Neanderthal-AMH hybrid child, dated at *c.*24,500 – 25,3000 BP (Trinkaus and Zilhão 1999), and known as the Lagar Velho child (Duarte *et al.* 1999). This find sparked open criticism (Tattersall and Schwartz 1999) and rekindled the never fully extinguished (but mellowed down) discussion about the exact degree of kinship between *Homo sapiens* and Neanderthals, now intrinsically related to the types of behavior and the differences between degrees of 'modernity' of both groups.

In *The Logic of Inference in Transition Research*, Clark (2001) accused the Indigenists of 'radical archaeological essentialism' for dismissing all the evidence that conflicts with their preconceptions, as they set out to prove –whatever it takes- that no acculturation process took place. Clark thinks that their model is undermined by strong correlations between climate and stratigraphic frameworks of the kind explained below. The weakest pillars upon which the Indigenist model is based are: their belief that Chatelperronian and Aurignacian units can be differentiated clearly, as they are 'typologically discrete' and that Neanderthals produced Chatelperronian assemblages while Aurignacian ones are the work of modern humans.

A problem that destabilizes this discussion as a whole and prevents it from achieving a satisfactory answer, or at least a more developed stage of study, is surely the fact that even now, researchers have still not reached a consensus on what exactly the term 'acculturation' means or made clear exactly what is it that each of them means when writing about it.

In *Time, Space and Cultural Process in the European Middle-Upper Paleolithic Transition*, Harrold and Otte (2001) consider the Indigenists' conclusions to be premature, and repeat the warnings against using El Pendo, Le Piage and Roc-de-Combe as evidence of any sort. Despite this, some authors continued to make use of those stratigraphic sequences, as mentioned above, Harold and Otte still believe that current evidence favors the Acculturation/PDH side.

The discrepancy over adaptation to different environmental conditions can be summarized as follows:

- the Indigenists think that modern humans would have difficulties in adapting to mild woodlands (in areas like the Périgord or south from the Ebro) until after the Arcy Interstadial, by which time (a warmer period) there are no Chatelperronian remains. The subsequent colder conditions would have favored their dispersal.
- PDH supporters defend the view that warm conditions would have been favorable for modern humans' dispersal and bad for Neanderthals, who would retreat to *refugia*. According to this perspective, events would have taken place earlier than suspected by Indigenists and a longer period of contact would have taken place. They should now explain what stopped moderns at the north bank of the Ebro (if anything at all) and how did Neanderthals survived for 10 ky under the warm conditions which must certainly have prevailed in southern Iberia's environments.

Supporters of the Acculturation hypothesis are also left to explain how the number of personal ornaments found at Grotte du Renne could be higher than the total number of such pieces found within Aurignacian contexts, since Neanderthals were supposed to be either copying them without understanding, or collecting such items from modern humans' sites in various ways (White 1993).

It is very necessary at this stage to identify, in the degree of resolution which present day radiometric dating methods allow, and thoroughly investigate simultaneous or semi-contemporary Aurignacian and Chatelperronian sites in a single area. Otherwise, our clarity is hampered by their lack of precision and the necessary lengths of the standard deviations.

Rather than advancing towards the solving of the different puzzles that the origins of this debate posed, one feels as if this later phase not only has failed properly to address them, but has added some more questions and complications, many times because of the inflexibility of various authors in simply maintaining their existing attitudes (failure to address colleagues' new proposals, focusing on entrenched points of view, etc.). The same situation predominated during the earlier stage.

Discussion and concluding remarks

New publications on the Transition to the Upper Paleolithic are appearing in print, as they have been doing for the last thirty years. But where are we? What progress have we actually made, in respect to where we were when the debate started?

As new sites have been discovered, fresh perspectives have been presented and discussed. However, these have been included into the body of 'facts' by some, and ignored by others. One wonders if the latter are really unaware of these developments or whether they are well aware of them but simply choose not to mention them, because they just do not fit in: the 'talking past one another' effect, as discussed by Willermet and Clark (1995). A good example of this is the rather variable use made by different authors of McBrearty and Brooks' important paper in the Journal of Human Evolution (2000), in which they prove the idea of the 'behavioral revolution' postulated by the tenets discussed in the first part of this paper to be completely flawed as they point to the existence of each and every one of the key characteristics being present in the African continent, several thousand years prior to their earliest traces in Europe.

So, in light of the above, is there really a debate? Is there a dialogue? It is hard to deny the existence of dissenting opinions, after more than three decades running around the same old issues, but it is much harder to see a real dialogue, when biases and preconceptions formed during each researcher's formative years permeate each and every aspect of the issues that form the Transition's controversy.

It becomes even more complicated when attempting to make progress in a field where so many different aspects and corresponding techniques and disciplines combine. An absolutely key inhibiting factor is that some basic, common, crucial terminology means one thing for a group and very different ones for other parties (*e.g.* the Aurignacian, and all its subdivisions, to mention but one). If this is to continue, the addition of more data is just not going to make matters any easier, in spite of what some are inclined to think (*e.g.* Klein 1989).

Perhaps, especially those who feel that the discussion is just going on and on (and chances are that it will continue like this for a long time to come), we should ask ourselves what kind of answers we are expecting as a possible final conclusion to the Mid-Upper Paleolithic Transition's debate. Are we looking for some great new single discovery that will sort out the confusion and give us an answer like 'yes, it did happen, and in this and that way' or 'no, it never happened, and it was all the product of typological systematics and a few other concepts and ideas made up from the late 19th century onwards'? Such an event is very unlikely to happen, and even if it did, chances are that the discipline would remain divided on its real significance and implications, because even when researchers acknowledge the existence of other scholars' studies, they do not always agree about their methods and interpretations. Or are we then bound to continue wondering what really happened and what the Transition really means and never find an 'answer' to all the questions that this phenomenon engulfs?

One of the main points of the author at the meeting from which this volume originates was to highlight that, what is so far known about the Transition in the Iberian Peninsula, is highly conditioned by a very critical research bias, that has historically focused fieldwork and research in two main areas (Catalunya and Cantabria), and only in the last fifteen years or less is starting to disappear as studies begin to include other areas of the region (Camps 2003, 2006). As mentioned above, it is crucial to understand the effect of the poor distribution of publications on research carried out at present. Authors' perspectives and conclusions cannot be modified if subsequent discoveries, and the results of the application of methodological improvements and new theoretical stances are not explained beyond the regional or national borders. Some Spanish researchers complain about how processes such as the Transition are usually explained by foreign hypotheses, often constructed without a thorough analysis of evidence from the Peninsula. Yet a more extended or international circulation of information related to those phenomena, does not appear to be among many scholars' priorities. Unfortunately, other papers at the meeting seemed to report that a very similar problem is also affecting other regions.

Researchers aiming at making progress on the Mid-Upper Paleolithic Transition must urgently address some 'preliminary issues', some of which are outlined below:

- the exact meaning of basic terminology.
- the effects of pan-continental generalizations that mask important regional details and variations.
- the need to eliminate research biases that are accountable for the lack of studies in certain areas.
- the need to develop a modern and comprehensive database of dates obtained by absolute methods.
- the implications of the haphazard use of typological systematics and their inherent biases and shortcomings, as these systems are still at the core of most Middle and Upper Paleolithic studies.
- the necessity to develop multidisciplinary projects that go beyond the obsolete typological analyses of assemblages in separate layers.
- to aim at understanding issues like environmental adaptations of human groups and fauna, seasonality-related variability and the effects that this changes would have meant for such groups.
- the means by which traces of the aforementioned adaptations and changes can be observed through the archaeological record.
- the re-assessment of known and controversial sites and their stratigraphy in light of recent post-depositional and site-formation studies.

The effects of the newer multi-disciplinary approaches that were unthinkable when this debate began should not be combined with old and stale analytical methods that we most of us acknowledge to be obsolete, and of limited use if any at all, if we are aiming at real progress. Perhaps taking two steps back before going one step forward is the key to getting closer to the final answer, whatever this may be.

Post-scriptum

During the months while this volume was being compiled and edited, the focus of the debate has shifted slightly from the acculturation processes mentioned above to what is being called "the interstratification" controversy (Gravina *et al.* 2005, Zilhão *et al.* 2007, Mellars *et al.* 2007). It concerns mainly different views on the stratigraphies of sites already mentioned above, such as El Pendo, Le Piage, and Roc-de-Combe, as well as others, such as the classic Grotte des Fées at Châtelperron, the type site for the denomination of Chatelperronian assemblages. The opinions diverge on the exact position of such assemblages in relation to the Aurignacian ones, and the significance that one being there earlier than the other would have in terms of the very beginning of the Upper Paleolithic and the driving forces, which human population exactly, would have fueled such process.

Dating methods, and more precisely some of the innovations developed during the late 1990s and early 2000s, such as ultrafiltration for AMS radiocarbon also play a crucial role in this new, and as always in this field, extremely fascinating, focus of research; however, it is interesting to note how, despite the “progress” that the opening of a new lead of research always constitutes, the concluding remarks section above remains as valid as when it was originally written, more than three years ago.

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2. A crossed-glance between southern European and Middle-Near Eastern early Upper Palaeolithic lithic technocomplexes: Existing models, new perspectives

Foni Le Brun-Ricalens, Jean-Guillaume Bordes and Laura Eizenberg

In Memoriam Denise de Sonneville-Bordes

> "Without at least a commonly understood vocabulary, we cannot even communicate with each other meaningfully. This is reflected in so many publications over the past twenty years and over almost all aspects of Upper Palaeolithic concerns, from its origins to its end. It is time to develop that vocabulary. Whether or not the specific proposals and definitions put forth in this paper are accepted is not important. If they can serve as a base from which to arrive at other, clearer concepts and definitions, it is fine with me. Let us do it."

A. E. Marks 2003

(in Goring-Morris and Belfer-Cohen (eds) 2003, *More than meets the eye*, 264)

ABSTRACT

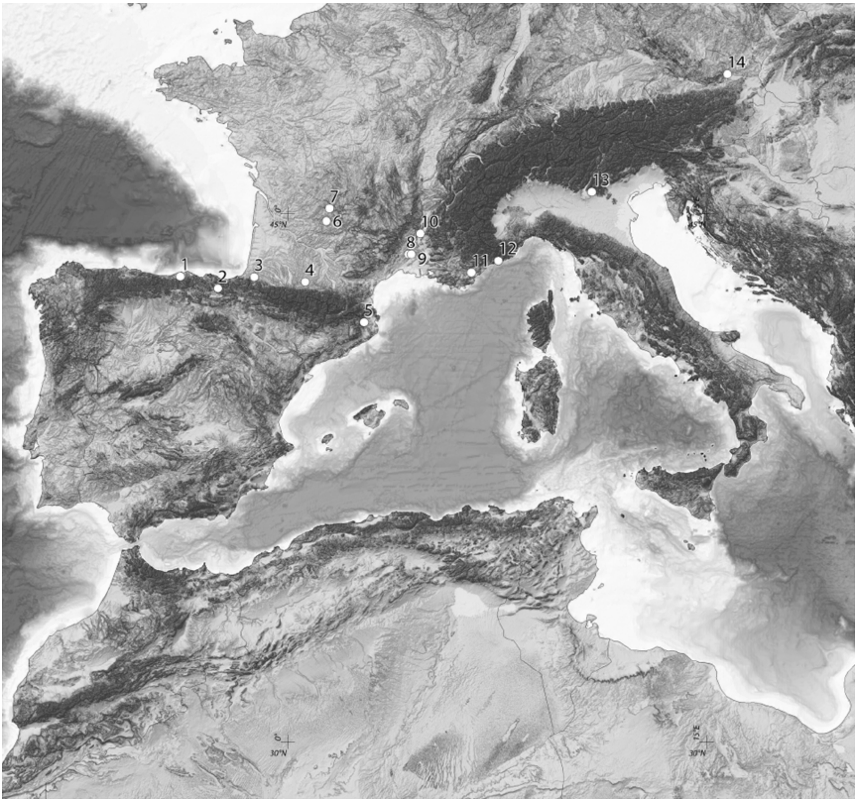
The aim of this article is to offer a critically-oriented comparative crossed-glance at lithic industries from the South-West of Europe on the one hand, and the Near and Middle East on the other, with a particular emphasis on modes of bladelet production. Indeed, this type of production seems to be one of the key elements for understanding the transition from the Middle Palaeolithic to the Upper Palaeolithic. The objective of this contribution is to find a common ground for the vocabulary used to describe these productions. In this perspective, we propose an updated techno-typological classification of retouched bladelet armatures, based on the original definitions of known types. This first review opens the discussion on chronocultural models traditionally applied to the initial phases of the circum-Mediterranean Upper Palaeolithic.

Introduction

Since the end of the 20th century, a renewed interest in the regions around the

Mediterranean has been the focus of studies concerning the transition from the Eurasian Middle to Upper Palaeolithic. Numerous sites have provided abundant documentation on the subject, allowing us to define with greater precision the models of chrono-cultural evolution commonly used from southern Europe to the Middle East. The arguments raised in this article are based on new archaeological evidence of two kinds: on the one hand, a revision of chrono-stratigraphical sequences with taphonomic aspects taken into consideration, and on the other, the analysis of the data resulting from a techno-typological study of lithic assemblages, with a focus on bladelet productions. The consideration of new criteria to caracterise retouched bladelets and their systems of production has highlighted the fact that this tool category is a *major significant marker* of the Upper Palaeolithic.

Depending on the geographic zone, the variations observed within retouched bladelets may be interpreted on a diachronic level (chronological marker), a synchronic level (geographical marker), or even on an economic level. The systematic techno-typological studies of lithic industries in western Europe (Tixier *et al*. 1980; Inizan *et al*. 1995), especially those concerning the first expressions of the Aurignacian, have lead the authors to review the current understanding of Aurignacian retouched bladelets and to compare, as part of a working hypothesis, the newly developed nomenclature (cf. § 5 and Figure 2.2) with sub-contemporaneous Near and Middle Eastern technocomplexes. Lastly, a few techno-typological convergences and differences will be presented and discussed.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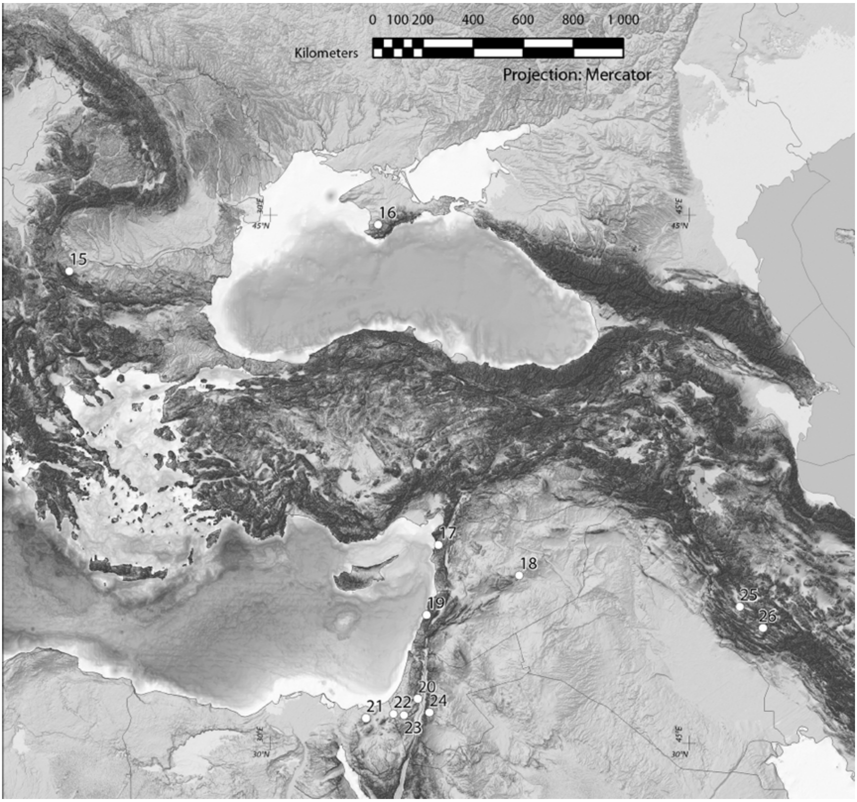


Figure 2.1 Location of principal sites mentioned in the text. 1. Morin, 2. Labeko Koba, 3. Isturitz, 4. Les Abeilles, 5. Abreda, 6. Le Piage, 7. Dufour, 8. Esquicho-Grapaou, 9. La Laouza, 10. Mandrin, 11. Rainaude, 12. Mochi, 13. Fumane, 14. Krems, 15. Kozarnika, 16. Siuren, 17. Üçağizli, 18. Umm el Tlell, 19. Ksar 'Akil, 20. Erq el Ahmar, 21. Lagama, 22. Nizzana XIII, 23. Boker A, 24. Tor Sadaf, 25. Warwasi, 26. Yafteh. (Map J.-N. Anslijn, source Smith and Sandwell 1997; source data: NASA, Shuttle Radar Topography Mission).

Key background issues

Recent syntheses have turned their interest to the two extremes of the Mediterranean (western Europe and the Near and Middle East), following over a century of research in these regions, thereby enabling a reopening of the debate concerning the transition from the Middle to the Upper Palaeolithic. A number of possible scenarios have been put forward to explain the emergence of the first expressions of the Upper Palaeolithic, and more specifically the Aurignacian, in these two distinct geographical zones. There are three main conflicting theories: those who favour a rapid replacement (e.g., Gilman 1984; Demars and Hublin 1989; Mellars and Tixier 1989; Mellars 1992, 1996, 1998, 2005, 2006; Djindjian 1993; Bar-Yosef 1998, 2003; Mellars *et al.* 1999), those who believe in a progressive diffusion, from east to west (e.g. Otte 1990, 1996; Zilhão and d'Errico 1999, 2003a, b; Kozlowski and Otte 2000a, b; Zilhão 2001; Otte and Kozlowski 2005), or from west to east (e.g. Bernaldo de Quiros 1982, 1994; Bernaldo de

Quiros *et al.* 2001; Cabrera Valdes and Bischoff 1989; Cabrera Valdes *et al.* 2001; Arrizabalaga and Altuna 2000, 2003; Maillo Fernandez 2003, etc.), in combination (or not) with those who lean towards a gradual *in situ* evolution in certain regions (e.g. Oliva 1989; Svoboda and Siman 1989; Svoboda 2003, 2004; Bordes 2002; Conard and Bolus 2003).

Geographical and historical contexts

Southern Europe and the Near East (see Figure 2.1) have both been the subject of numerous decades of research, which we will briefly outline here. In the first half of the 20th century many archaeological investigations were undertaken in these geographical areas, attesting to their important role in the elaboration of an evolutionary framework for the western and levantine Aurignacian (*sensu lato*).

Europe

In western Europe, the classification used to define the technical traditions of the early Upper Palaeolithic result from the 19th century pioneering work of E. Lartet and G. de Mortillet. In this geographical zone, the French model from the Aquitaine region has become a reference point following the principal research initiated at the beginning of the 20th century by H. Breuil (1906, 1913), later developed through the work of D. Peyrony (1933, 1936), followed by D. de Sonneville-Bordes (1960). This latter researcher generalised the use of the statistical method, originally introduced by F. Bordes in 1950 for the Lower Palaeolithic, for the classification of industries of the Upper Palaeolithic (Bordes 1961). In the second half of the 20th century, research increased with an evergrowing number of Palaeolithic lithic specialists,[1] too numerous to be listed here.[2] The late 80s saw a renewal of chronocultural partitioning (Zilhão and d'Errico 2000) thanks to complementary approaches, in particular the dynamic information gained from the study of lithic technology (e.g. Tixier 1963, 1978; Pelegrin 1986; Haudricourt 1987; Collins 1975; Johnson and Morrow 1987; Basalla 1988; Karlin 1991; Philips 2003), thus allowing for a better understanding of the industries, more particularly those of the western Aurignacian (e.g. Bon 2002a, b, 2006; Bordes 2005, 2006; Le Brun-Ricalens and Bordes in press).

Near East

The first syntheses regarding the evolution of the Palaeolithic cultures of the Near East were established in the 1930s by two English researchers: R. Neuville (1934, 1951) and D. A. E. Garrod (1938, 1951). This period also witnessed the work of the American J.-W. Murphy (1938), followed by the post-war works of J. F. Ewing (1947), R. B.-L. Braidwood and B. Howe (1960), E. Wreschner (1966), L. Copeland (1970, 1976; Copeland and Hours 1971) and the Frenchmen J. Perrot (1955), F. Hours (1966, 1974) and J. Tixier (1970, 1974; Tixier and Inizan 1981).

During the 1970s, the subdivisions of the levantine Aurignacian were updated (Copeland 1975; Besançon *et al.* 1977). Similarly, during the 1980s a new generation of prehistorians contributed to updating the evolutionary framework of the Upper Palaeolithic based on new excavations undertaken by various researchers of the Levant, such as, O. Bar-Yosef, I. Gilead, A. N. Goring-Morris, or Americans such as A. Marks, and J.-L. Phillips[3] (e.g. Bergman 1988b; Bergman and Stringer 1989; Coinman 1998; Gilead and Bar-Yosef 1993; Marks 1981a, b, 1983, 1990, 1993a, b; Marks and Kaufman 1983; Marks and Ferring 1988; Olszewski 1997). The conference held in London in 1987 entitled "*The levantine Upper Palaeolithic with special Reference to Ksar 'Akil"* (Bergman and Goring-Morris 1987) consolidates the recent chronocultural subdivisions with the adoption of a new technocomplex, the Ahmarian (Gilead 1981; Marks 1981a),[4] a term suggested by E. Anati in 1963.

Middle East

Aside from some fieldwork in the Middle East, syntheses of the Palaeolithic of this region remain rare, in particular for the Aurignacian of the Zagros, also called the Baradostian (Solecki, 1958). In this context, such research includes that of C. Coon (1951), R. S. Solecki (1955, 1966), D. A. E. Garrod (1957), T. C. Young and P. E. L. Smith (1966); F. Hole (1966), F. Hole and K. Flannery (1967), M. Piperno (1974), P. E. L. Smith (1986) and P. Mortensen (1993).

Since the end of the 20th century, the Middle East, especially the Zagros region in Iran, has been the subject of new research with, on the one hand, the study of old collections, and on the other hand the undertaking of new fieldwork (e.g. Olszewski 1993, 1999, 2001; Olszewski and Dibble 1994; Otte and Kozlowski 2003, 2004; Jaubert *et al.* 2004; Otte *et al.* 2007; Otte in press).

Review of the current data

Methodological advances

In the framework of this contribution, our line of argument is based not only on new chrono-stratigraphic evidence resulting from the re-examination of sequences from a taphonomic point of view, thanks to the re-opening and excavation of a number of archaeological sites in the south-west of France (Le Piage, Isturitz, etc.), but also on new data resulting from techno-typological examinations of lithic industries in general, and more particularly of bladelet productions attributable to the Upper Palaeolithic.

New techno-typological approaches:
The role of Upper Palaeolithic bladelet productions

Since the end of the 20th century, the generalisation of technological studies has contributed to underlining the importance of bladelet productions in Palaeolithic tool-kits, from an economic as much as from a chrono-cultural point of view. Some recent works have shown that the study of bladelet production (modes and objectives) provides excellent criteria for differentiating lithic industries of western Europe's Upper Palaeolithic (Brou and Le Brun-Ricalens 2005). The caracterisation of *chaînes opératoires* (Tixier 1978; Pelegrin 1986) regarding bladelet productions (Chazan 2001, 2003) has led to a better understanding of the causal relations between different bladelet morphologies and different types of cores (prismatic, pyramidal), including tools in the typological sense (core-endscrapers: carinated and nosed; core-burins: carinated, busked, flat, and Vachons burins, etc.) (Marks and Volkman 1983; Le Brun-Ricalens 2005; Le Brun-Ricalens *et al.* 2005; Belfer-Cohen and Grosman in press). Refits at various sites have played a significiant role in demonstrating these close ties, and in the validation of the different operational processes recognised within the *chaînes opératoires*.[5]

The Aquitaine Model revisited: the example of Le Piage

The ‘Aurignacian/Perigordian interstratifications’: the end of a myth

The site of Le Piage (Lot, France) is well known for containing an interstratified Chatelperronian level within an important Aurignacian sequence (Champagne and Espitalié 1981). Employed as direct support for the validity of D. Peyrony’s parallel Aurignacian and Perigordian cultural phylum, the interstratification at Le Piage, together with that at Roc-de-Combe, a site situated two kilometers to the south-west, became the strongest evidence for the contemporaneity of the final Neanderthals and the first anatomically modern humans within the same region (Bordes and Labrot 1967; Champagne and Espitalié 1967, 1981). It turns out, however, that these two ‘interstratifications’ are not real, but in fact caused instead by post-depositional mixing. This calls into question the model of acculturation of Neanderthals by modern humans (Bordes 2002, 2003).

Confirmation of the occurrence of the Proto-Aurignacian in southwestern France

The importance of this sequence and the debates which followed (Mellars 1989, 1996, 1999; d’Errico *et al.* 1998) justified re-evaluation of its validity. In the aim of testing this validity, a taphonomic analysis of its lithic industries led to two major results. The area of the site which uncovered the interstratification is in actual fact a mix of various industries (Bordes 2002, 2003). Furthermore, the refits between and within the layers demonstrated an important incline of the material in the direction of the slope. For the rest of the site, the typo-technological analysis has shown that the top of the Aurignacian sequence corresponds to an early typical Aurignacian, recognised in numerous sites of south-western France, while its base (layer K) corresponds to an industry previously unknown in that region, which can be tied to the Proto-Aurignacian or archaic Aurignacian, as it is defined for the areas surrounding the Mediterranean and the Pyrenees (Bon 2002a, b; Arrizabalaga *et al.*, this volume). Le Piage is thus the first site to show a chronology of these two facies (Bordes 2002) in the Aquitaine basin,[6] a proposition already advanced for the south-west of France by G. Laplace (1966), H. Delporte (1968), G. Onoratini (1986), F. Le Brun-Ricalens to J. Pelegrin *in litteris* (1989), P.-Y. Demars (1992).

The re-opening and resuming of old excavations such as at Isturitz at the foot of the Pyrenees (Normand 2002; Normand and Turq 2005) on the one hand, and the re-examination of old collections, such as those of the caves of Les Abeilles (Laplace 1966; 2006; Eizenberg 2006) and Dufour, on the other, all support this new chrono-cultural framework. In addition, in all case studies observed and re-examined presently, the Chatelperronian is always anterior to the Aurignacian (Harrold 1989; d’Errico *et al.* 1998; Zilhão and d’Errico 1999, 2000; Bordes 2002, 2003; Zilhão *et al.* 2006; Arrizabalaga *et al.* this volume).

As a result, the traditional Aquitaine model is updated as such, as shown in Table 2.1.

And what of the Middle Eastern model?

If we deliberately disregard radiocarbon dates and presumed human types, research carried out in the Near and Middle East allows us to put forward the following evolutionary model concerning the Middle to Upper Palaeolithic transition technocomplexes (Table 2.1).

After the Balkans and the Bacho Kirian (Kozlowski 1999; Kozlowski and Otte 2000a, b), the Middle East, including Iraq and Iran, is sometimes seen as a probable origin of the Aurignacian. This proposition has been refuted for the Bacho Kirian (Tsanova and Bordes 2003; Teyssandier 2003, 2006; Teyssandier *et al.* 2006; Rigaud and Lucas 2006; Otte and Kozlowski 2005; Tsanova 2006), which should now, in light of these, be more appropriately considered as a transitional industry anchored in Middle Palaeolithic debitage concepts, but economically and typologically approaching the Upper Palaeolithic.

Table 2.1 Succession of south-western and central European techno-complexes at the Middle to Upper Palaeolithic transition and succession of Middle and Upper Palaeolithic transitional technocomplexes in the eastern region of Eurasia (modified from Belfer-Cohen and Goring-Morris 2002).

Western Europe	*Central Europe*	*Near Eastern*	*Middle Eastern*
Western Aurignacian	Aurignacian	Levantine Aurignacian	Zagros Aurignacian
Proto-Aurignacian	Proto-Aurignacian	Early Ahmarian	(Early ?) Baradostian
Chatelperronian	Transition technocomplexes	IUP / Emiran	?
Mousterian	Mousterian	Mousterian	Mousterian

What we know of the situation in Iran is based solely upon a few rare sites. The only two sites recently published (Warwasi and Yafteh) seem to indicate different models, as outlined briefly below. Unfortunately, the evidence is still too limited to conclude in favour or not of a local origin for the Aurignacian.

For Warwasi (Olszewski 2001), a re-analysis of the material housed in the United States (University of Pennsylvania), demonstrates an important quantity of Middle Palaeolithic types (Levallois cores, sidescrapers) at the base of the Aurignacian sequence. These objects diminish progressively in number as one moves through the upper part of the sequence. Does this suggest an *in situ* transition or the mixing of levels?

For Yafteh, contrary to what has been suggested (Kozlowski and Otte 2000b; Otte *et al.* 2007; Otte in press), the base of the sequence does not contain any elements which allow the Baradostian to be tied to the Zagros Mousterian:[7] the assemblage is strictly composed of blades or bladelets produced with a soft hammer (Jaubert *et al.* 2004). On the other hand, a systematic projection of the retouched bladelets from Hole and Flannery's excavations (1967) succinctly demonstrates the following tendencies:

- at the base, there are large straight bladelets with a rectilinear or slightly curved profile carrying an inverse, alternate, or direct bilateral retouch (Arjeneh points).
- at the top there are instead small twisted bladelets with inverse or alternate retouch.

This evolution in bladelet production can be integrated within the general tendencies observed, as much in the Near East, as in central or western Europe (Table 2.1).

Current synthesis

Europe

Given the recent methodological advances discussed above, the traditional lithic taxonomy must be reconsidered (Sonneville-Bordes and Perrot 1953, 1954, 1955, 1956a, b; Hassan 1972; Copeland 1982, 1987; Demars and Laurent 1989). Bearing this in mind, one of us presented and attempted to test a new techno-typological taxonomy for western European Aurignacian retouched bladelets (Le Brun-Ricalens 2003).

For western Eurasia, bladelet production is differenciated by unique debitage schemes which are validated by stratified enclosed assemblages. Furthermore, many of these bladelet production schemes represent chrono-cultural phases (Bordes 2005, 2006).

To briefly sum up[8] the principal tendencies observed (Figure 2.3), we distinguish within the taxonomic unit of 'Dufour' bladelets, characterised by inverse or alternate, semi-abrupt retouch:

- large, straight Dufour bladelets with a rectilinear profile which are more frequently seen in the *Proto-Aurignacien*. They are obtained from prismatic (or pyramidal) cores and on the edge of flakes by a unipolar debitage method that is intercalated, in continuity or not, within blade production (Bazile 1974, 2002, 2005; Sicard 1994, 1995; Bazile and Sicard 1999; Bon 2002a; etc.). Demars and Laurent (1989, 102) refer to these pieces as 'subtype Dufour';
- small, straight Dufour bladelets with a rectilinear or curved profile which characterise the typical *Aurignacien ancien* and basically issued from an independent debitage scheme on endscraper-cores of a carinated or nosed form. These pieces have also been referred to as 'sub-type Dufour' by Demars and Laurent (1989, 102). Bon (2002a) has proposed to label the mesial fragments of these pieces as 'sub-type Brassempouy';
- small Dufour bladelets, sub-type Roc-de-Combe (Demars and Laurent 1989, 102), generally skewed (*déjetées*) to the right with a twisted profile, hallmark of the *Aurignacien récent*. These bladelets principally come from an independent core-burin technique (carinated or busked), but also from nosed-endscrapers/ cores with a narrow face;
- large twisted or straight bladelets most frequently with a direct retouch, but very occasionally with inverse or alternate retouch, obtained from facetted core-burin or core-burin of the Vachons type which marks the *Aurignacien final* (Pesesse and Michel 2006).

Middle and Near East

The current state of research in the Middle and Near East seems to amount to similar observations and has reached a similar understanding regarding technological advances and typology. However the authors still struggle to agree on the terminology of retouched bladelets, as is ironically pointed out by C. A. Bergman (2003, 188),[9] as well as by L. Copeland (2003, 245) "[…] *I deplored the inclusion of so many variants*".

This discord had already been noted in the last quarter of the 20th century. J. Tixier (1970) has shown that retouched bladelets were much more abundant than previously thought, and that certain types even remained unknown before 1969 (Tixier et Inizan 1981). What is striking about the literature on the subject of lithic industries in the Near and Middle East is the lack of an updated unified terminology following the Wenner Gren Symposium of London in 1969 published by F. Hours in 1974 under the title *"Liste-type développée pour le Paléolithique* *supérieur et l'Epipaléolithique du Liban"*. In Nairobi in 1977, M.-L. Inizan and J. Tixier announced their plan to work on a common nomenclature based on a large list. Furthermore, J. Tixier was conscious of the importance of studying retouched bladelets and wrote that he was formulating a statistical programme to analyse retouched bladelets. They wished to retain a classification system which took neither the debitage type, nor the extent of the retouch along the edge (partial, total), into account (Tixier and Inizan 1981, 357). Notwithstanding, at the beginning of the 21st century, this work still awaits presentation (Eizenberg 2005).

Bladelets and retouched points: a certain terminological confusion

Problems concerning the terminology employed to characterise the diversity of retouched bladelets, in particular pointed bladelets, is regularly underlined in the literature (Azoury and Hodson 1973; Besançon *et al.* 1977; Copeland 1975; Copeland 1986, iv-ix; Bergman 2003). The principal definitions commonly used, some of which overlap, correspond to the following types: el-Wad, Abu Halka, Ouchtata, Arjeneh and Dufour.

The 'el-Wad' type

The 'el-Wad' point ('el-Ouad' for the francophones) was initially proposed to describe retouched points on twisted blanks (Garrod and Bate 1937, 48). Later on, the 'el-Wad' point was the object of the following definition in 1969: "Small pointed blade or bladelet with a fine direct retouch" (collective, 1970, 38; Hours 1974). Depending on the authors, the application of this term was more or less 'interpretive' (e.g. Bar-Yosef 1970; Bar-Yosef and Belfer-Cohen 1977, 1981, 1988; Belfer-Cohen 1980; Belfer-Cohen and Bar-Yosef 1981; Copeland 1970, 1975; Copeland and Hours 1971; Azoury 1971, 1986; Marks 1976; Bergman 1987, 1988a), the term 'el-Wad' having been progressively used by extension to describe various types of 'points' on twisted or untwisted bladelets, not to be confused with the 'Ksar 'Akil' point made primarily on blades.

The habitual application of the term, 'el-Wad', to numerous retouched bladelet types demonstrates that the definition itself is too large (Bergman 1981, 2003). There exists a certain heterogeneity in the application of the definition *princeps* that does not consider certain morphological differences of the initial blanks (straight, twisted), variability in size (long, small), also in the location of retouch (direct, inverse, alternate) and in the type of retouch (short, semi-oblique, semi-abrupt, etc.).

The 'Abu Halka' type

Although rarely used, the morphotype of 'Abu Halka' point is defended by C. A. Bergman (1981, 326, 2003, 187) in reference to the work of I. Azoury (Bergman citing a personal communication of I. Azoury in 1977). This point should be considered as forming part of the variabililty of the 'el-Wad' point and is described as being an axial bladelet characterised by inverse or alternate retouch on one or two edges.

'Ouchtata bladelets'

Depending on the location of a particular retouch type called 'Ouchtata' by J. Tixier in 1963, in reference to the excavations of the Ibero-Maurusian site of

Ouchtata (Gobert and Vaufrey 1932, 465), three types are distinguised: an acute bladelet with Ouchtata retouch, Ouchtata bladelets, and bladelets with Ouchtata retouch; this distinction does not take into account fragments of Ouchtata retouched bladelets.

According to J. Tixier, "'Ouchtata retouch' is a direct retouch (very rarely inversed), short or very short, often light, semi abrupt or slightly abrupt, never resulting in a backing, sometimes slightly irregular, almost always more pronounced in the proximal part of the piece, so faint in some instances that it requires careful close examination, sometimes even with the use of a microscope, to detect the retouch. This retouch can, in certain rare cases, resembles the "Dufour" type" (Tixier 1963, 48). (See Note 10 for original quotation).

- *'Acute bladelet with Ouchtata retouch'*

  A pointed bladelet presenting Ouchtata retouch on the entirety of one rectilinear or slightly arched edge (type 69 of Tixier 1963, 115).
- *'Ouchtata' bladelet*

  A bladelet having a sharp edge (generally the right), blunted by direct retouch of the type Ouchtata. This retouch, commencing from the proximal section of the piece without removing the butt, reduces towards the distal non-retouched section of the piece, be it acute or obtuse (type 70 of Tixier 1963, 115).
- *Bladelet with 'Ouchtata' retouch*

  A bladelet presenting on one or both of its edges Ouchtata retouch (direct, inverse, alternate, or alternating) which differenciates a type different from the two desribed previously (Type 71 of Tixier 1963, 116).

Arjeneh or Arjenah point

Term employed in the Middle East to characterise straight bladelets with a pointed end formed by direct retouch, most often short and bilateral.

Retouched bladelet 'en virgule'

Worth mentioning, but unknown to our knowledge in the literature, are the bladelets *'en virgule'* (shaped like a comma) mentioned by J. Tixier and M.-L. Inizan in reference to the material from Ksar 'Akil. These pieces are described as small twisted bladelets with direct, semi-abrupt retouch on both edges (Tixier and Inizan 1981, 360).

Dufour bladelet

This term, borrowed from the western European typology (Sonneville-Bordes and Perrot 1953, 1954, 1955, 1956a, b), is still employed by various authors to describe bladelets, often twisted, but also straight, bearing a semi-abrupt inverse or alternate retouch (e.g. Belfer-Cohen and Goring-Morris 2002; Marks 2003).

Comments

More clearly than that of the 'family Dufour' of western Europe, the 'family el-Wad' of the Near East occupies the role of 'catch-all' for the retouched bladelets from the beginning of the Upper Palaeolithic.

From the time C. A. Bergman proposed the terminology in 1981, the actual typology employed today to catogorise the retouched bladelets from the beginning of the Upper Palaeolithic has proven to be insufficient, as already pointed out by J. Tixier at a conference in Lyon organised in honor of F. Hours (Bergman 2003, 188). The present typology does not adequately consider the diverse morphologies and modules of the blanks, nor the location and extent of retouch. Such a typological approach, but which also integrates the characteristics specific to bladelet debitage, would be a good starting point for establishing a techno-typological seriation. As already noted by L. Copeland (1975, 340–341) “*It must be stressed that Font-Yves (or el-Wad) points proper (that is, points with fine distal retouch on bladelets, often curved at the distal end, and not retouched at the butt) do not occur in Lebanon until the Aurignacian, so that we are surely dealing with two kinds of artifacts, which should be kept separate”*. Furthermore, C. A. Bergman (2003), A. Belfer-Cohen and Goring-Morris (2003) equally stress the necessity of re-examining the so-called ‘*fossiles directeurs’* that are in fact common to both the early Ahmarian and the Aurignacian. Diverse pioneering studies in lithic technology (e.g. Ohnuma 1988; Ohnuma and Bergman 1990; Bar-Yosef and Kuhn 1999), in particular the very informative refitting programmes carried out in recent years for certain technocomplexes (notably with the early Ahmarian*)*, have provided new and useful insights (e.g. Monigal 2003; Davidzon and Goring-Morris 2003; Goring-Morris and Davidzon 2006).

In this contribution, it seems relevant to integrate two complementary approaches, the explicative (technology) and the descriptive (typology), followed by a comparison of western and eastern models.

A first attempt at critically evaluating terminologies…and products

This contribution proposes a new techno-typological classification which takes into account technological modes of production from different types of bladelet-cores on the one hand, and bladelet blank dimensions (long, small), morphology (straight, twisted), type (inverse, alternate, direct) and retouch location (1 side, 2 sides) on the other hand, while making the distinction between pointed bladelets (whether naturally pointed (*pointue*) or pointed by retouch (*appointée*)) and unpointed bladelets (Figure 2.2). As it stands, this proposal uses neutral and objective terms, and avoids old denominations as they may represent more than one type; Given that the existing denominations vary from one author to the other, they are given simply as a rough guide (Figures 2.3 and 2.4).

Methodological prudence

From a methodological point of view, and at this preliminary stage of our work, it is important that we remain prudent regarding the methodology. In order to avoid logical empirisism, we must increase the number of analytical tests before drawing syntheses. A tendency to generalise leads to simplified and reductionist ideas and we feel that other current research shall better our understanding. As such, this contribution remains a “working hypothesis”. In this sense, the structure of the table proposed shall stay flexible, in order to be modified or completed. We wish to keep our distance from rigid models such as those proposed by such tables, and let the fieldwork and archaeological material speak first and foremost, but at the same time recognising that models help to provide a generalised overall view-point. Nonetheless, we should stay clear of reductionist models which may take on a caricatural aspect on the scale of human behaviour. Syntheses should not be restrictive nor blend over particularities.

Seeing and doing…
Regarding techno-cultural comparative analogies, in archaeology more than anywhere else perhaps, we ought to be wary of hasty interpretations of convergences. In the human sciences, what works in one area does not necessarily work in another. In this sense, it is necessary to return to studying lithic assemblages with a new critical look and updated methodologies, in order to refuel the debate in a constructive fashion.

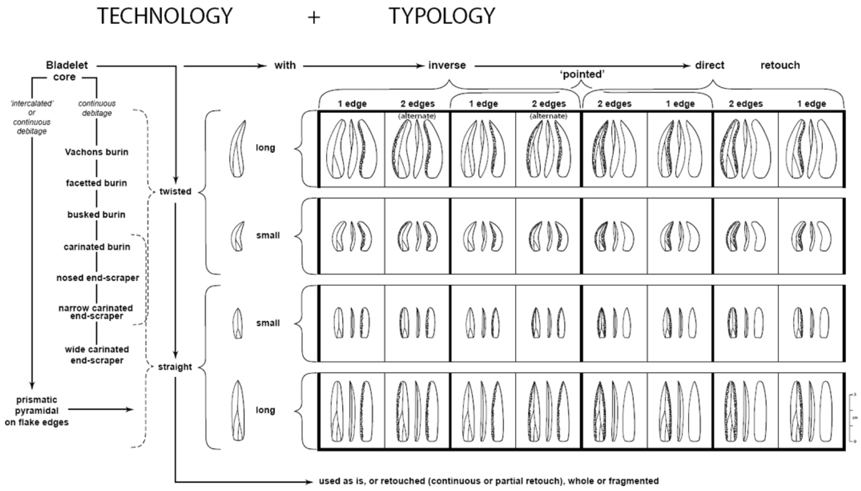
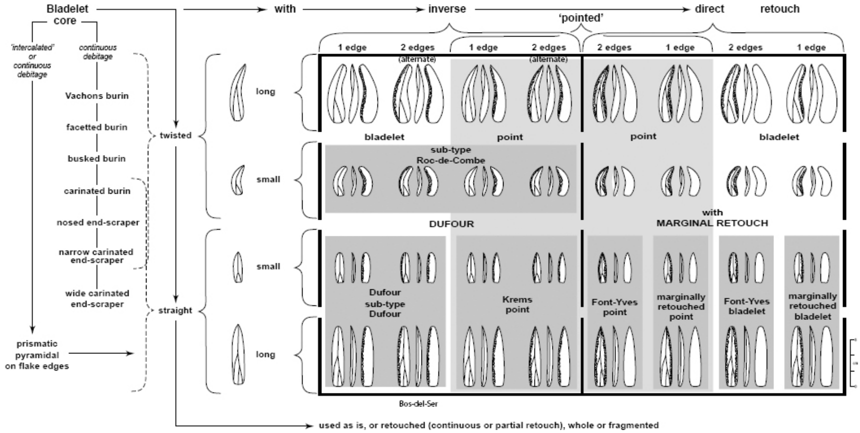

TECHNOLOGY
+
TYPOLOGY
Bladelet core
'intercalated' or continuous debitage
continuous debitage
Vachons burin
facetted burin
busked burin
carinated burin
nosed end-scraper
narrow carinated end-scraper
wide carinated end-scraper
prismatic pyramidal on flake edges
twisted
straight
long
small
small
long
with
inverse
direct
retouch
'pointed'
1 edge
2 edges (alternate)
1 edge
2 edges (alternate)
2 edges
1 edge
2 edges
1 edge
cm
used as is, or retouched (continuous or partial retouch), whole or fragmented

Figure 2.2 Proposed technotypological classification of retouched bladelets from the Western European early Upper Palaeolithic. Categories are organised hierarchically according to morphological and metrical aspects of the bladelet blank (criteria indicated on the left) and aspects of the retouch (criteria indicated at the top); on the left (from bottom to top): differing bladelet morphologies classified according to the type of profile (straight/twisted) and the length (long/small); at the top (from left to right): categories proposed according to the location of the retouch (inverse / alternate / direct), on 1 or 2 edge(s), and the distal morphology of the bladelets (pointed/not pointed).


Bladelet
core
'intercalated' or continuous debitage
continuous debitage
Vachons burin
facetted burin
busked burin
carinated burin
nosed end-scraper
narrow carinated end-scraper
wide carinated end-scraper
prismatic
pyramidal
on flake edges
twisted
straight
long
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with
inverse
direct
retouch
'pointed'
1 edge
2 edges (alternate)
1 edge
2 edges (alternate)
2 edges
1 edge
2 edges
1 edge
bladelet
point
point
bladelet
sub-type Roc-de-Combe
DUFOUR
with MARGINAL RETOUCH
Dufour sub-type Dufour
Krems point
Font-Yves point
marginally retouched point
Font-Yves bladelet
marginally retouched bladelet
Bos-del-Ser
used as is, or retouched (continuous or partial retouch), whole or fragmented

Figure 2.3 Proposed technotypological classification of retouched bladelets from the Western Aurignacian. This categorisation preserves the original nomenclature (with the two large generic families bordered in black and indicated by bold capitals), while also integrating the general and more specific terminologies used subsequently by some researchers, as shown respectively by the large groupings on white/light grey background and the smaller groupings on dark grey background.

Convergences and differences

Retouched bladelets from the beginning of the Upper Palaeolithic of Europe and the Near and Middle East present at once differences and convergences with each other in both the realms of technology and typology.

Differences

Among the notable differences between the two geographical zones, there is, on the one hand, an under-representation of certain types of bladelets in the West (such as the direct retouched bladelets[11]) and, on the other hand, differences in the frequencies, with a notably larger representation of direct retouch on large twisted bladelets and of Ouchtata bladelets in the Near East where they are particularly abundant.

Technological convergences

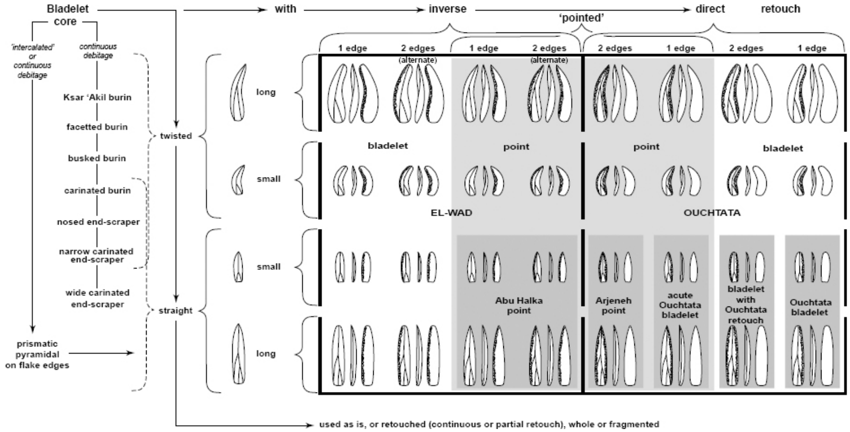
From a technological point of view, the production of straight and twisted bladelets is well documented due to the increasing number of detailed examinations, refitting work and experimentations in recent years (Ploux 1998; Soriano 1998; Slimak *et al.* 2002; Ploux and Soriano 2003) carried out as much in the west (Le Brun-Ricalens *et al.* 2005) as in the east (Lindly *et al.* 2000; Chazan 2001; Monigal 2003; Davidzon and Goring-Morris 2003; Goring-Morris and Davidzon 2006). Bladelet debitage schemes present numerous analogies on either side of the Mediterranean, with the same end-products obtained from the same procedures.

Typological convergences

From a typological point of view and as early as the beginning of the 20th century, some authors (who were initially trained with the western prehistoric taxonomy) pointed out similarities between different artefact types, notably bladelets pointed by direct retouch, named in some instances Font-Yves points, Krems points, el-Wad points or even Arjeneh points (Kozlowski 1993).

"*We can distinguish points from the Near East, but why call them Krems points and not Ksar 'Akil or el Wad points ?*" (Perrot 1968, column 361).[12] On this subject, F. Bordes calls them "*Font-Yves orientales*" (Bordes 1968, 173).

Similarly, many scholars have noted resemblances between Dufour and el-Wad bladelets, and in rarer cases Ouchtata bladelets.


Bladelet
core
'intercalated' or continuous debitage
continuous debitage
Ksar 'Akil burin
facetted burin
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nosed end-scraper
narrow carinated end-scraper
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1 edge
2 edges (alternate)
1 edge
2 edges (alternate)
2 edges
1 edge
2 edges
1 edge
bladelet
point
point
bladelet
EL-WAD
OUCHTATA
Abu Halka point
Arjeneh point
acute Ouchtata bladelet
bladelet with Ouchtata retouch
Ouchtata bladelet
used as is, or retouched (continuous or partial retouch), whole or fragmented

Figure 2.4 Proposed technotypological classification of retouched bladelets from the early Ahmarian of the Zagros and Levantine Aurignacian. This categorisation preserves the original nomenclature (with the two large generic families bordered in black and indicated by bold capitals), while also integrating the general and more specific terminologies used subsequently by some researchers, as shown respectively by the large groupings on white/light grey backgrounds and the smaller groupings on dark grey background.

In order to obtain a greater number of detailed comparative characteristics, we propose that the archaeological community examine these convergences with the aid of the techno-typological classification presented in Figure 2.2.

In many lithic assemblages, the distinction between small bladelet/long bladelet/small blade remains an arbitrary heuristic exercise (Adams and Adams 1991). The approach and classification system proposed here rest on a combination of recurrent technological and morphometrical criteria (Coinman 2003), namely, the dimensions of the blank (length, width, thickness), the shape of the blank, its profile, silhouette, cross-section and the orientation of the negative flake scars on its dorsal surface. In terms of the technocomplexes dealt with here, the boundary between small and long bladelet tends to occur between 25 and 30 mm in length.

Interpretations and discussion

At this stage of the investigation it is surprising to observe that the west mirrors the east in terms of objectives and modes of bladelet productions of the Upper Palaeolithic. What do these industrial entities represent and how can we interpret the strong techno-typological similarities observed between the sides of the

Mediterranean?

Can the variations recorded within retouched bladelets be interpreted as chronological markers (diachronic approach), as geographic markers (synchronic approach), as techno-cultural markers, and/or as behavioural markers (activity markers, for example specialised hunting)? This questioning once again evokes the issue of the origin(s) of these technocomplexes: a genesis from a local tradition depending on the region (gradual indigenous change theory) or diffusionism (rapid allochtone exogenous replacement theory) with the arrival – or not – of new human populations (Modern humans *versus* Neanderthals).

New perspectives: a progressive model

Multifocal innovations and circulation of ideas

Although certain authors defend the theory of an *in situ* evolution from the Middle Palaeolithic traditions towards those of the Upper Palaeolithic, the majority of researchers agree on a more or less abrupt colonisation of Eurasia by anatomically modern humans as the source of this famous "transition". An alternate solution, intermediate to these two opposing theories, favours decoupling cultural evolution from biological evolution, in order to better treat the available data. We believe that our observations of the archaeological register may not be interpreted as waves of populations. Similarly, it seems impossible to discuss the geographic or technological origin of the Aurignacian, not due to a lack of dating precision, nor to a paucity of sites, but simply because an origin of the Aurignacian never existed – in the anthropological sense; rather, we are faced with a progressive mosaic appearance of new socio-economic behaviours (Straus 1996, 2003).

Thus, in light of the new litho-technological data collected on either side of the Mediterranean (Marks 1988; Bordes 2002; Tostevin 2003; Goring-Morris and Davidzon 2006), nothing opposes itself to the possibility of an *in situ* evolution from local transitional technocomplexes (Chatelperronian in the west, and intermediate facies/IUP/Emiran in the east for example), anchored in the local Middle Palaeolithic substrate. From a technological point of view, there are no more differences with the previous facies than with the one that follows, which fully expresses itself in the form of a typical Aurignacian as it is classicly defined (Bordes 2002, 2006).

Therefore, an alternative theory exists between diffusionism and *in situ* evolution, which encompasses ideas of a progressive integration – without break – of a new "technical idea" (Marks 1988; Meignen 1996), in this instance the "bladelet concept", which fits within the continuity of technical tradition. This hypothesis, which can be compared to a phenomenon of gradual evolution eventually coupled with a *technical transfer* (Creswell 1982, 1992), does not rely on the movement of human groups over large distances. The necessary technical knowledge having been acquired since the end of the Middle Palaeolithic, this new way of doing could have emerged in different places from a non-rigid knowledge-base from which new conceptions may have developed (Meignen and Bar-Yosef 2004, 2005).

Success of the "bladelet" concept

At the beginning of the Upper Palaeolithic one of the major changes in the lithic tool-kit is, in our opinion, the success of the "bladelet" concept (together with its associated core) (Brou and Le Brun-Ricalens 2005). This new concept offers the opportunity of being adapted differently and gradually in time and space (Kuhn and Elston 2002). Within this "bladelet concept" we see the intention to produce "points" by a convergent bladelet debitage with eventual retouch, in particular in the first phases of the Baradostian, the early Ahmarian and the Proto-Aurignacian (e.g. Kuhn *et al.* 2003; Monigal 2003; Coinman 2003; Fox 2003; Fox and Coinman 2004; Jaubert *et al.* 2004).

Little big tool: "high-tech" point

Compared to the Middle Palaeolithic, bladelet production does not play the same role and fully comes into being from the beginning of the Upper Palaeolithic (Slimak 1999; Slimak and Lucas 2005). The explanation behind the new vogue of the "little big tool" probably resides in its efficient adaptation to a vast territory (Bon 2005) and its adequacy to free itself from ecological and environmental constraints (mineral and animal resources). Indeed, this compact technical solution (small transportable cores ensuring a high production yield of small interchangeable blanks) is highly useful for an immediate or postponed use, as much in the domestic realm (knife elements) as in the hunting realm (armature elements).[13] The versatility of this new technology may have led to ensuring the adoption of this technological innovation (Bleed 1986). This pioneering phenomenon of armature microlithisation (Kuhn 2002) is seen to have been adopted in differing expressions and by a number of technocomplexes right up until the Neolithic.

This hypothesis of "local invention with or without technical transfer" brings to light the unity and diversity of the Aurignacian. The intrinsic qualities of the *bladelet idea*[14] (the concept, their numerous applications, etc.) may explain the monolithic perception of a mosaic process. In addition, contrary to a linear view, it is possible to intergrate phenomenons of retro-action, techno-cultural feed-back inherent in the timing of adoption and assimilations of innovations. This phase of adaptation may vary in terms of regions and receptivity of human groups. Therefore this hypothesis needs to consider certain constraints linked to cultural traditions (Perlès 1993).

From "technological transfer" to "cultural transfer"?

In the framework of this "technological transfer" concerning lithic technology (Creswell 1982; Haudricourt 1987), it may be wise to include other components such as "bone technology" which is also in full development at this stage. In this perspective, we could stretch this notion to include that of a "cultural transfer" (symbolic, social and personal expressions). Could other aspects of material culture, such as art, personal adornments, etc. (White 1982, 1989, 1996; Otte 2003; Kuhn *et al.* 2001) be superimposed on a same model? It is important to stress here that the presence/absence of such indicators for certain regions are not necessarily a historic reality, rather they may be the result of taphonomic effects or recovery biases (Szmidt, this volume).

Thus, do these different forms of expression form part of a similar circum-Mediterranean polygenetic process of local invention/adoption of exogenous ideas? This therefore raises the following questions: according to which modes of communication did these *savoir-faire* and "transfers of ideas" operate and according to which modes did the various regional responses develop? These questions will not be addressed here (Meignen and Bar-Yosef 2004).

Techno-typological outlook for new directions

This contribution offers a new harmonised system of comparison based on a techno-typological classification of retouched bladelets of the Upper Palaeolithic, presented here to serve as a starting point for discussion. As bladelets and their mode of production seem to be an interesting key to understanding Pleistocene lithic assemblages from one end of the Mediterranenan to the other, it seems wise to attempt to unify the descriptive vocabulary by basing it on explicative foundations. This terminology has proved efficient in Europe for the renewal of approaches concerning, for instance, the western Aurignacian (Brou and Le Brun-Ricalens 2005), and, although not a panacea, may prove to be equally useful for certain issues linked to the lithic assemblages of the Near and Middle East. Amendments and completions still need to be done, while other categories of retouched bladelets were not, for example, integrated (bilateral inverse retouch, variability of partial retouch, lateralization, etc.). In addition, we encourage other future work of a similar nature to include other complementary approaches, including for example use-wear studies (Bergman and Newcomer 1983; Williams 1997; Becker 2003; Boëda and Bonilauris 2006) and lithological studies, or to refine certain technological descriptions such as the techniques of bladelet removal and retouch methods, as well as the spatial analyses of domestic activities.

In order to pursue the questions raised for the two zones on either side of the Mediterranean, other paths of reflection should be explored, for instance the status of the south of central Europe (e.g. Broglio and Laplace 1966; Hahn 1970, 1977; Laplace 1970, 1977; Bartolomei *et al.* 1992; Broglio 1993, 1995; Broglio *et al.* 2005; Kuhn and Bietti 2000; Kuhn and Stiner 1998; Koumouzelis *et al.* 2001; Kuhn 2002; Uthmeier 2004; Teyssandier 2006; Teyssandier *et al.* 2006; Tsanova 2006; Tsanova *et al.* in press). What role did this intermediate location play? Autonomous (r)evolution and/or meeting point or turning point between the east and the west? Let us hope that these enquiries, as well as others outside of Europe (e.g. Garrod 1953; Kozlowski 1992, 1999; Minzoni-Deroche 1992; Otte 1997, 2004; Kuhn *et al.* 1999, 2001, 2003, 2004; Marks and Monigal 2004; Brantingham *et al.* 2004), will contribute, on the one hand, to shedding further light on the choice of appropriate model, pan-mediterranean or not, between 45 000 and 25 000 ky, and on the other hand to specifying who were the authors of these technocomplexes (e.g. Mann 1995; Churchill and Smith 2000; Stringer 2002; Currat and Excoffier 2004; Mellars 2004; Trinkaus 2005).

Face to face and crossed glance: more than meets the eye…

In the zones surrounding the Mediterranean, as elsewhere, the human reality of the Palaeolithic may have been much more complex than what is suggested by existing "face to face" models (mono- or multicultural phenomenon) proposed to explain the passage of societies from the Middle Palaeolithic to the Upper Palaeolithic. With this modest crossed glance, the techno-typological elements observed incite us to formulate a new hypothesis, more nuanced, that of a polygenetic origin of the Aurignacian according to a progressive phenomenon integrating multifocal regional evolutions and transfers/assimilations or not of extra-regional ideas. By combining past and modernity, this proposal allows for the respect of particularities attached to each technocultural tradition between cultural heritage and technical innovation. A hypothesis in the image of the *bladelet*: points of convergence within diversity…

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Notes

1. Notably the creation after the war in France of different research structures (French CNRS created in 1945, university teaching posts, administrative and scientific districts, EHESS, etc).
2. Noteworthy contributions for the Aurignacian include A. Leroi-Gourhan (1963, 1965), G. Laplace (1966), H. Delporte (1968), J. Hahn (1970, 1977), M. Otte (1979), J.-Ph. Rigaud (1982), P.-Y. Demars (1992), F. Djindjian (1993) (not a complete list).
3. For a background see Belfer-Cohen and Bar-Yosef 1999; Eizenberg 2005.
4. For a synthesis, the reader is encouraged to consult the excellent publication edited by A. N. Goring-Morris and A. Belfer-Cohen (2003) whose objective review and critical and varied conclusions raise pertinent perspectives.
5. For a synthesis see Le Brun-Ricalens et al. 2005.
6. Bearing in mind this issue, new investigations at the site of Le Piage began in 2004 as a collaboration between the University of Bordeaux (J.-G. Bordes) and the National Museum of History and Art of Luxembourg (F. Le Brun-Ricalens).
7. The rare ‘discoidal cores’ (Kozlowski and Otte 2000b, 10) are in fact bifacial preforms of bladelet cores.
8. The differences mentioned are sometimes less marked, depending on the assemblage. Certain retouched bladelets caracteristic of certain phases can equally be found in smaller numbers in certain assemblages of other phases (ex. small Dufour bladelets in the Proto-Aurignacian). The interpretation rests, therefore, on the relative proportion of bladelet

types (and ther associated cores) to other types, while also taking into consideration the techno-economic character of the rest of the lithic assemblage, bone industry and associated fauna, etc.

9 “Lazy levantine prehistorians have been guilty of not applying rigorous taxonomic schemes” Bergman (2003, 188).

10 “Retouche directe (très rarement inverse), courte ou très courte, n’entamant jamais largement le bord qu’elle intéresse, semi-abrupte ou légèrement abrupte, ne formant jamais de dos, parfois un peu irrégulière, presque toujours plus marquée dans la partie proximale de la pièce, si ténue sur certaines lamelles qu’il faut un examen très attentif.voire une loupe binoculaire– pour la déceler. Cette retouche peut, dans certains cas assez rares il est vrai, se rapprocher du type “Dufour”

11 On which greater attention must be paid.

12 “On peut distinguer les pointes du Proche-Orient, mais pourquoi les nommer pointes de Krems plutôt que pointes de Ksar ‘Akil ou d’El Ouad ?”

13 As indicated by various use-wear studies.

14 Strong attraction thanks to its flexibility and ease of production, first and foremost, as well as its underlying efficiency (law of the Thorndicke effect).

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3. The Middle-Upper Palaeolithic hiatus of insular north Africa

Angela E. Close

Abstract

The prehistory of Mediterranean North Africa to the west of Egypt has always been shaped by the Sahara Desert. Throughout the period of 50,000–25,000 years ago, the Sahara was extremely arid and all life was confined to a thin (or vanishingly thin) coastal strip. The Middle Palaeolithic (the Mousterian and Aterian) was made by modern humans. It is known from Jebel el Akhdar (Cyrenaica), Jebel el Gharbi (Tripolitania) and the Maghreb. There is no evidence that it lasted after about 40,000 years ago. In the Upper Palaeolithic, the Dabban appears in Jebel el Akhdar at about 40,000 years ago and in Jebel el Gharbi at about 30,000 years ago. It may have ended in both areas by about 25,000 years ago, and it never reached the Maghreb. The backed-bladelet industries (above all, the Iberomaurusian) spread across North Africa a little before 20,000 years ago. At no time is there detectable evidence for contact across the Strait of Gibraltar. Mediterranean North Africa becomes more understandable when it is viewed as a series of islands: the Nile Valley, Jebel el Akhdar, Jebel el Gharbi and the Maghreb. The islands have permanent sources of drinking water and are separated from each other by hundreds of kilometres of coast-line, where the Sahara meets the Mediterranean and there is rarely drinking water. Human groups became isolated from each other on these islands and some, even though they were modern humans, became locally extinct.

Introduction

Geographically, my charge extends from the Egyptian-Libyan border, which, in this time-range, is a less arbitrary limit than it at first seems, to the western end of the Mediterranean and then beyond the Mediterranean to include some very relevant material from the Atlantic coast of northwestern Morocco. However, and of equal importance, any serious consideration of the southern shores of the Mediterranean must also take into account the great Sahara Desert (Figure 3.1). Today, the Sahara is the driest desert in the world; very little of it receives more than 25 mm precipitation per annum (primarily orographic rainfall in the Hoggar and Tibesti), and some parts receive none at all. It is also the largest desert in the world; at about 9,000,000 km^2, it is rather larger than the continental United States and it extends southwards from the Mediterranean coast some 15°–20° latitude (Messerli *et al.* 1980). At some periods in the past, most recently in the final Pleistocene and early Holocene, the Sahara has seen significant rainfall and it has then acted as an enormous hinterland for the Mediterranean coast. At other periods, it has not merely not provided a hinterland, but it has actually encroached upon the coast and expanded northwards to meet the sea itself, as it does today. All of this is dependent on rainfall, which has always been the most important determinant in North African prehistory and has been much more important than variation in temperature was in the rest of the Mediterranean basin. When temperatures fell, populations along the Mediterranean coasts beyond Africa usually had the option of moving to somewhere warmer, but when rainfall ceased in North Africa, there was not always anywhere to move to.

The Middle Palaeolithic (Middle Stone Age) of Mediterranean North Africa

The Middle Palaeolithic of Mediterranean North Africa certainly began before the Last Interglacial (Oxygen Isotope Stage [OIS] 5e) and, thus, long before the period of interest here. It includes two major units, the Mousterian and the Aterian, which overlapped considerably in time. It is likely that the Mousterian began earlier than the Aterian, but, within North Africa as a whole, neither seems to have outlasted the other. There is some tendency for the Mousterian to be more common in eastern North Africa and for the Aterian to be more common in the west. However, since the Mousterian occurs as far west as Morocco and the Aterian occurs as far east as the Nile Valley, these are no more than tendencies.

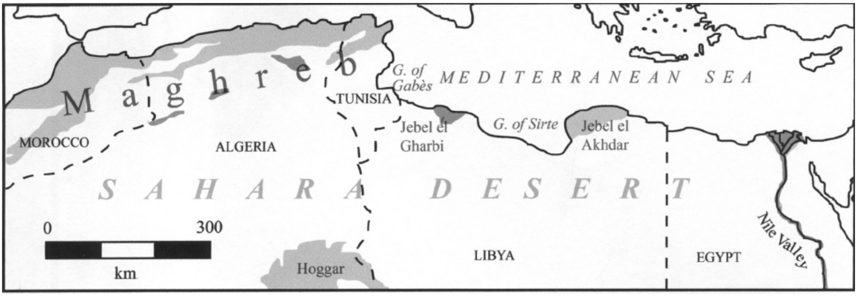

Figure 3.1. Mediterranean North Africa. Dashed lines are political borders and shaded areas are those where (some) fresh-water is available.

In terms of stone artifacts, the Mousterian is very similar to Charentian and Denticulate facies of the Mousterian as known in Europe and southwestern Asia. I view this similarity as culturally meaningless. Convergence happens and, at this level of technology, is almost unavoidable. For example, Villa, in a study of stone artifacts from the Middle Stone Age site of Sibudu (South Africa), found it useful to compare them to those of the European Middle Palaeolithic (Villa *et al.* 2005). Similarly, Wurz and her colleagues (2005) concluded that there is the same kind of variability in the Middle Stone Age material from Klasies River Mouth (South Africa) as there is in the Middle Palaeolithic of the Egyptian Nile Valley.

In terms of associated hominins, however, the southern Mediterranean Mousterian differs profoundly from that elsewhere around the sea. In Europe, the Mousterian is found only with Neandertals. In southwestern Asia, the Mousterian is associated with Neandertals, except at Skhul and Qafzeh, where modern human beings were present at about 90,000–100,000 years ago, both before and after the Neandertals. In North Africa, the Mousterian is found only with moderns, there never having been, of course, any Neandertals in Africa. The Mousterian layers at Jebel Irhoud (Morocco) yielded a series of well-preserved human fossils, which Hublin (1992) considers to be very similar to the moderns at Skhul and Qafzeh. The Irhoud specimens are almost certainly older than OIS 4 (Hublin 1992, 186–187); electron spin resonance (ESR) dates indicate an age between 90,000 and 125,000 years ago (early uptake [EU]) or between 105,000 and 190,000 years ago (late uptake [LU]) and, thus, probably within OIS 6 (Grün and Stringer 1991, 185–186). The Mousterian layers of the Haua Fteah (Libya) yielded fragmentary human remains that were originally grouped with the "Neandertaloids" of southwestern Asia (Tobias 1967, 347–349), but have now returned to the fold of modern human beings (Hublin 2000, 160–161). The uppermost Mousterian at the Haua has finite radiocarbon dates of 43,400 BP ± 1300 years and 47,000 BP ± 3200 years (McBurney 1967, 71). Both samples were processed in 1961 and we may be confident that the real age is considerably older.

There is very little information concerning when the Mousterian ended (Figure 3.2). Indeed, the ESR and radiocarbon dates given in the previous paragraph are almost the only ones available, and most estimates of the age of the final Mousterian are based on stratigraphy. Thus, in Cyrenaica, the Mousterian ended no later than *c.* 45,000 years ago at the Haua Fteah. At Jebel El Gharbi, in western Cyrenaica, Mousterian underlies an Aterian which has radiocarbon dates of 43–44,000 BP (Garcea 2004, 33–34).

In the Maghreb, apart from the dates for Jebel Irhoud, there is also a date of 50,240–52,950 cal BP for the Mousterian at Ifri n'Ammar in eastern Morocco (Eiwanger and Mikdad 2003; no raw dates or details of calibration are given); the overlying Aterian has dates of 36,960–41,030 and 38,570–41,020 cal BP. Undated Mousterian is also stratified beneath Aterian at three other sites in eastern Morocco: Rhafas, Station Météo (Wengler 1997) and, perhaps, Taforalt (Roche 1953). Since the Aterian itself ended *c.* 40,000 years ago (I return to this below), this provides a *terminus ante quem* for the Mousterian at those sites.

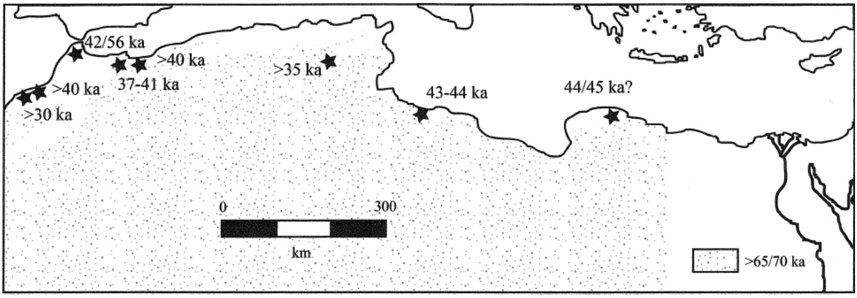

Figure 3.2. Least problematical dates for the end of the Middle Palaeolithic. From West to East, the sites are: Dar-es-Soltane; Témara (Grotte des Contrebandiers); Mugharet el 'Aliya; Ifri n'Ammar; Taforalt (Grotte des Pigeons); Bir el Ater; Jebel el Gharbi; Haua Fteah.

The end-date of the Mousterian in the Sahara Desert is more complex and must be viewed through the prism of history. In the early 1950s, Quaternary studies in the Sahara (as in the rest of the world) were revolutionised by the invention of radiocarbon-dating. Archaeologists and geologists alike rushed into the desert and took samples of anything that might be dated by the new technique. Unfortunately, ideal sample-materials are not common in the Sahara, so that many of the samples were snail-shells, ostrich eggshells, carbonate concretions, travertines and carbonate-rich lake-deposits (Fontugne 1997, 394). It was three decades and over a thousand dates later that realisation came (but is still not universal) that such dates were not reliable. However, samples were processed and dates were produced. Some were finite and were accepted uncritically; others were infinite and more likely to be correct, but some researchers treated the lower limits of infinite dates as if they were finite (Camps 1974, 35). Because of the limits of radiocarbon-dating, these approaches resulted in a peak of dates beginning around 35,000–40,000 BP and extending down to about 20,000 BP. The samples had been selected because they were related to water and were expected to give dates for wet periods in the Sahara. Thus, there came into existence in the literature an important Upper Pleistocene wet phase beginning about 35,000 years ago and lasting until perhaps 20,000 years ago. The end of the Saharan Mousterian would have fallen within this wet phase, probably in the earlier part.

It was known that radiocarbon could not give reliable dates older than 45,000 years (or 40,000, or, nowadays, even 25,000–30,000 years [Voelker *et al.* 1998]), so that when other dating techniques were developed (ESR, luminescence, uranium-series etc.) that could go beyond the radiocarbon-barrier, they were rapidly adopted within the Saharan research-community. The new techniques were not without their own problems (Fontugne 1997, 95–97; Taylor and Aitken 1997), but it soon became apparent that they were not detecting a wet phase at 35,000 years ago. Instead, the last major wet phase before the terminal Pleistocene/Holocene ended by about 70,000 years ago (Wendorf and Schild 1992, 56; Wendorf *et al.* 1993, 566), or 65,000 years ago (Szabo *et al.* 1995; Smith *et al.* 2004), in the Egyptian Sahara; by at least 60,000 years ago in the Tadrart Acacus in central Libya (Cremaschi *et al.* 1998); by 75,000 years ago in two North-South transects across the central Sahara (Fontes and Gasse 1991); by 77,000 years ago at Le Shati in northwestern Libya (Gaven 1982); by 80,000 years ago in the south-central Sahara (Baumhauer *et al.* 1997); and by 80,000 years ago in the region of the Great Eastern Erg (Ballais and Heddouche 1997). Any subsequent increases in moisture were very minor until the end of the Pleistocene. Thus, in the Sahara, the Mousterian, which was associated with a wet phase, must all be older than 65,000–70,000 years (Figure 3.2). Unfortunately, the apocryphal 35,000–20,000–years-old wet phase still remains in the literature to trap the unwary.

I emphasise that these dates are given to provide a *terminus ante quem* for the Middle Palaeolithic; I do not suggest that they mark the end of a prolonged period of rainfall. Indeed, it is more probable that the dates refer to rather short (a few millennia) wet phases. Wetter conditions over much of Africa (and Asia) result from strengthening of the southwest Indian monsoon system. The monsoon system, in turn, undergoes millennial-scale changes in response to orbital forcing, and these changes may be significantly modified by abrupt episodes of deglaciation (Overpeck *et al.* 1996, 213–215). Thus, the last wet phase began around 12,500–13,000 years ago and ended about 6000 years ago (and, inevitably, included drier subphases). Overpeck *et al.* (1996, 219) believe that changes in monsoon strength lagged about 3000 years behind changes in North Atlantic ice-cover. More recent work has not always detected the time-lag but high-resolution records show very close similarities (on centennial and even decadal scales) between fluctuations in monsoon-strength and in the GRIP $\delta^{18}O$ record until about 8000 years ago, since when the prime mover has, again, been orbital forcing (Fleitmann *et al.* 2003).

There was a similar rather brief set of wet episodes in the Eastern Sahara beginning in the final stages of the Penultimate Glaciation (OIS 6). These episodes seem to correlate with the OIS 6/5e transition and either the OIS 5b/5a or the OIS 4/3 transition (Wendorf *et al.* 1993, Figure 38.5). Actual dates from the Sahara tend to have large standard deviations, but the dates of the oxygen-isotope stages are known quite precisely. Thus, the Upper Pleistocene Saharan wet-phases were probably each a period of only a few millennia falling at about 125,000 years ago, (perhaps 110,000 years ago), 85,000 years ago and 65,000 years ago.

The other part of the North African Middle Palaeolithic is the Aterian, which was originally defined as “Mousterian with tanged tools” (Tixier 1967, 786). In 1967, Tixier gave a much more precise definition of the Aterian as, “A Mousterian with Levallois – and often blade – technology (with a high proportion of faceted platforms), with numerous side-scrapers, relatively abundant points, and a frequency of end-scrapers (often on the end of a blade) which is higher than in any other Mousterian facies. A noticeable proportion (sometimes as much as a quarter) of the toolkit consists of pieces with a tang at the proximal end, usually worked on both faces” (Tixier 1967, 795). This definition makes no mention of bifacial foliates, but his typological “Aterian group” (Group V) is defined as “[the number of untanged end-scrapers + the number of tanged pieces + the number of bifacial foliates] × 100/total number of tools”, and he proposed a bifacial index (number of bifacial tools × 100/number of tools) to characterise the later Aterian (Tixier 1967, 797).

The Aterian is found all across North Africa, but is most common in the western part, with particularly dense concentrations of sites known around Casablanca, Oran, Algiers and Tébessa (Tixier 1967, 776). Hominin fossils are associated with the Aterian at four sites in Morocco (Dar-es-Soltane, El Harhoura, Mugharet el ‘Aliya and Témara) and all are unquestionably modern human beings (Hublin 1992, 185–186).

For the date of the end of the Aterian within the Sahara, the same arguments apply to the Aterian as to the Mousterian, so all the Aterian in the desert must be older than 65,000 years.

In Cyrenaica, McBurney (1967, 130) tentatively identified Aterian within the Mousterian sequence at the Haua Fteah; it is, thus, much older than 45,000 years. To the west, in Jebel el Gharbi, Aterian has been dated between 43,000 and 85,000 years ago by uranium-series, and radiocarbon (AMS) dates suggest a more specific age of 43,000–44,000 years ago for the deposits incorporating the Aterian at Ras el Wadi (Garcea 2004, 33). It also has a radiocarbon date of about 43,500 years near Shakshuk (Garcea 2004, 34) (Figure 3.2).

Dating the end of the Aterian in the Maghreb is particularly contentious. Debénath (1992, 1994, 2000; Debénath *et al.* 1986) remains fiercely insistent that the Aterian lasted from about 40,000 to about 20,000 years ago. However, since Roubet (1969) found diagnostic Aterian artifacts in raised beaches of the Last Interglacial, we know that, even in the Maghreb, it existed long before 40,000 years ago, and there is increasing evidence that it may not have lasted much (if at all) after about 40,000 years ago. (Roubet was responsible for many of the known Aterian sites clustered around Algiers.)

Cremaschi *et al.* (1998, Table I) and Bouzouggar *et al.* (2002, Table 7) both give recent compilations of dates for the Aterian in the Maghreb. Table 3.1 is based upon their work, and I have added a few more dates that have been published very recently. The dates are given in order of dating-technique (radiocarbon, ESR, luminescence and uranium-thorium) and longer sequences are given before shorter sequences. In chastising Saharan scholars for their continued reliance on dates obtained from samples of dubious nature, Fontugne (1997, 402) observed that the simplest and least expensive remedy would be to purge them all from the literature. This seems an entirely reasonable approach to the radiocarbon dates in Table 3.1, with the probable exception of those from Ifri n'Ammar. I was able to identify only one sample as actually being charcoal. Some of the dates are manifestly too young – no-one seriously proposes that the Aterian lasted until after 20,000 years ago – and almost all of the finite dates of less than 40,000 years may be discounted because the stratigraphy shows them to be unreliable (very clearly so at Témara) or because they come from the same context as older or infinite dates (Taforalt, Dar-es-Soltane). Two of the samples of marine shells from Témara (Grotte des Contrebandiers) also gave uranium-thorium dates of almost 140,000 years. The two finite dates from Dar-es-Soltane are from the same context but differ by some 20,000 years. Occhietti *et al.* (1993, 1630) take this to indicate the unreliability of dates run on shells of terrestrial molluscs, which, in turn, casts doubt upon the one radiocarbon date from El Harhoura I. The archaeological assocation of the samples from Herbillon is not entirely clear: "in sandy deposit, with shells and charcoal, moustero-aterian [sic] tools, were found" (Hassko *et al.* 1974, 122). The ESR dates from Mugharet el 'Aliya make it very difficult to suppose that they apply to something <40,000 years old. The luminescence dates from El Harhoura are from the same context but differ by 9000 years, and one of the luminescence dates from Chaperon Rouge I is from above the Aterian. In sum, with very little special pleading, I am quite confident that none of the Aterian in the Maghreb has yet been dated as younger than 40,000 years old.

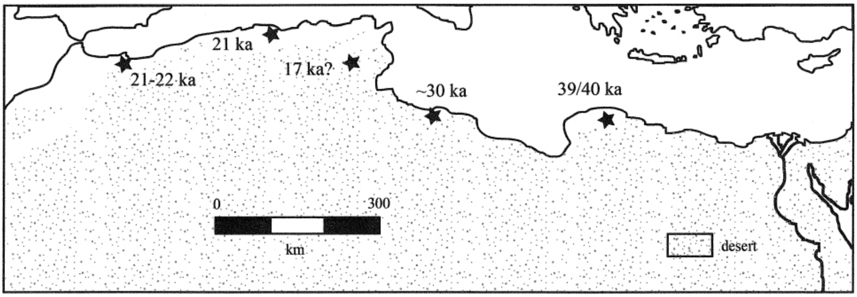

Figure 3.3. Least problematical dates for the beginning of the Upper or Late Palaeolithic. From West to East, the sites are: Taforalt (Grotte des Pigeons); Tamar Hat; Bir Oum Ali; Jebel el Gharbi; Haua Fteah.

The Upper/Late Palaeolithic (Late Stone Age) of Mediterranean North Africa

The earliest Upper Palaeolithic in Mediterranean North Africa is the Dabban, named for the site of Hagfet ed Dabba (McBurney and Hey 1955, 176–218) but better known from the Haua Fteah (both in Cyrenaica). At the Haua, the Dabban was stratified immediately above the Mousterian, to which it bore no resemblance (McBurney 1967, 166–167). It is a normal Upper Palaeolithic blade industry (in the European and southwest Asian sense), with backed blades, end-scrapers and burins varying in relative frequencies through time.

The only really distinctive artifacts are the chamfered blades (called "transverse burins" in the report on Hagfet ed Dabba [McBurney and Hey 1955, 176–218]). McBurney (1967, 143, 326–327) considered it significant that chamfered blades were also known in Egypt (Champ de Bagasse, Kom Ombo) and in the Emiran of southwestern Asia, and Bar-Yosef (2000, 25–26) also notes that chamfered blades occurred in both southwestern Asia (particularly at Ksar 'Akil) and in Cyrenaica. Neither McBurney nor Bar-Yosef could decide what to make of this. Nonetheless, wherever, specifically, the Dabban's links might lie, they must be generally to the east of Cyrenaica, since they could not be to the North (the Mediterranean, and no evidence of boating), to the West (where the Middle Palaeolithic had ended or was ending), or to the South (where the Sahara was in hyperarid mode).

McBurney's (1967, 326) contention that the Dabban first appeared in Cyrenaica at about 40,000 years ago is supported by its direct superposition over the Mousterian at the Haua and by a date of 40,500 BP ± 2000 years from ed Dabba itself (McBurney 1975, 419). It also occurs from farther west in Libya, in Jebel el Gharbi, first appearing at about 30,000 years ago (Garcea 2004, 33–34). It is unknown west of Jebel el Gharbi (Figure 3.3).

In the Maghreb, there is essentially a hiatus between the end of the Middle Palaeolithic, at 40,000 BP or earlier, and the appearance of the Late Palaeolithic (Iberomaurusian) a little before 20,000 BP (Figure 3.3). I am aware of only two possible indicators of human occupation. Some three decades ago, Delibrias *et al.* (1976, 593) reported a bladelet industry associated with a date of about 28,000 years ago on the Moroccan Atlantic coast, north of Agadir. The overlying crust dated to about 14,000 years ago and nothing more has been done at the site. Both dates were on marine shells. Much more recently, Barton *et al.* (2005, 86) report a multiple burin on truncation (plus undiagnostic flakes) from Kehf el Hammar (on the Moroccan coast east of Gibraltar) beneath sediments dating to about 22,000 years ago (radiocarbon) and about 23,400 years ago (OSL). These dates are scarcely earlier than those for the Iberomaurusian at Taforalt. In any case, some bladelets (?) and a burin constitute a very thin record of occupation for a period of almost twenty millennia across half of North Africa.

Table 3.1. Dates for the Aterian in the Maghreb (Radiocarbon [down to Station Météo 2], Electron Spin Resonance [Mugharet el 'Aliya], Luminescence [El Harhoura I and Chaperon Rouge I] and Uranium-Thorium [the last two dates from Témara])

Site	*Layer*	*Date BP*	*Lab. No.*	*Sample*	*Reference*
Témara	8	12,500 ± 170	Gif-2577	bone splinters	Delibrias *et al*. 1982
Témara	8	22,630 ± 500	Gif-2576	marine shells	Delibrias *et al*. 1982
Témara	9	14,460 ± 200	Gif-2579	bone splinters	Delibrias *et al*. 1982
Témara	9	35,200 ± 2100	Gif-2578	marine shells	Delibrias *et al*. 1982
Témara	10	12,320 ± 600	Gif-2580	bone splinters	Delibrias *et al*. 1982
Témara	11	24,500 ± 600	Gif-2582	bone splinters	Delibrias *et al*. 1982
Témara	11	>40,000	Gif-2581	marine shells	Delibrias *et al*. 1982
Témara	12	12,170 ± 160	Gif 2583	bone spinters	Delibrias *et al*. 1982
Témara	12	23,700 ± 1000	Gif-2585	carbonaceous earth	Delibrias *et al*. 1982
Témara	12	>35,000	Gif-2584	marine shells	Delibrias *et al*. 1982
Taforalt	18 ("transitional layer")	>32,370 +2470/-1890	Gif-2276	gastropod shells	Delibrias *et al*. 1982
Taforalt	19	>34,550 +3200/-2280	Gif-2277	gastropod shells	Delibrias *et al*. 1982
Taforalt	top of 19	>40,000	Gif-2589	carbonaceous earth	Delibrias *et al*. 1982
Taforalt	base of 19	>40,000	Gif-2588	carbonaceous earth	Delibrias *et al*. 1982
Taforalt	21	19,080 ± 250 and 19,400 ± 250	Gif-2278	gastropod shells	Delibrias *et al*. 1982
Taforalt	23	>40,000	Gif-2279	gastropod shells	Delibrias *et al*. 1982
Taforalt	26	21,860 ± 330	Gif-2280	gastropod shells	Delibrias *et al*. 1982
Dar-es-Soltane	Aterian	16,090 ± 90	TO-2046[a]	*Helix* shells	Occhietti *et al*. 1993
Dar-es-Soltane	Aterian	37,220 ± 290	TO-2045[a]	marine shells	Occhietti *et al*. 1993
Dar-es-Soltane	brown layer	>27,000	UCLA-678B	?	Wengler 1997 Ruhlmann 1951[b]
Dar-es-Soltane	red layer	>30,000	UCLA-878A	?	Wengler 1997 Roche 1956[b]
Herbillon	"sandy deposit"	27,870 +800/-700	Ny. 170	marine shells	Hassko *et al*. 1974
Herbillon	"sandy deposit"	30,330 +1870/-1520	Ny. 172	charcoal	Hassko *et al*. 1974
Ifri n'Ammar	Aterian layer	38,570–41,020 calBP[c]	KIA-8822	?	Eiwanger and Mikdad 2003
Ifri n'Ammar	Aterian layer	36,960–41,030 calBP[c]	KIA-8823	?	Eiwanger and Mikdad 2003
Aïn Maarouf	silty part of terrace	31,950 ± 600	GrN-1965	*Lymnea* shells	Wengler 1997
Bérard	?	31,800 ± 1900	I-3951	calcined limpets	Wengler 1997
Bir-el-Ater	?	>35,000	MC-657	snail shell	Camps 1974
El Harhoura I	1	25,580 ± 130	To-2047	*Helix* shells	Occhietti *et al*. 1993
Rhafas	2	14,060 ± 150	Gif-6489	?	Wengler 1993[d]
Station Météo 2	Terrace Fy2	15,100 ± 180	Gif-7627	?	Wengler 1993[d]
Mugharet el 'Aliya	5	42,000 ± 3000 (EU)	97123a[e]	bovid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	5	56,000 ± 5000 (LU)	97123a[e]	bovid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	6	41,000 ± 4000 (EU)	97122a[e]	bovid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	6	49,000 ± 5000 (LU)	97122a[e]	bovid tooth	Wrinn and Rink 2003

Mugharet el 'Aliya	9	47,000 ± 4000 (EU)	97121a[e]	bovid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	9	56,000 ± 6000 (LU)	97121a[e]	bovid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	10	64,000 ± 6000 (EU)	97120a[e]	equid tooth	Wrinn and Rink 2003
Mugharet el 'Aliya	10	85,000 ± 9000 (LU)	97120a[e]	equid tooth	Wrinn and Rink 2003
El Harhoura I	1	32,150 ± 4800	BOR-57 (γTL)	burned sandstone	Debénath 1992
El Harhoura I	1	41,160 ± 3500	BOR-56 (TL)	burned sandstone	Debénath 1992
Chaperon Rouge I	10 cm above Aterian layer	24,000 +3050/-4800	Ox-OSL724 g2	quartz grains	Texier *et al*. 1988
Chaperon Rouge I	Aterian layer	28,200 ± 3300	Ox-TL724 g	burned flint	Texier *et al*. 1988
Témara	8	137,000 ± 17,000	(Gif U-Th date)[f]	marine shells	Delibrias *et al*. 1982
Témara	9	138,000 ± 17,000	(Gif U-Th date)[g]	marine shells	Delibrias *et al*. 1982

a, from the same layer.
b, as cited by Cremaschi *et al*. 1998
c, Eiwanger and Mikdad do not provide the raw dates or details of the calibration
d, as cited by Bouzouggar *et al*. 2002
e, McMaster sample no. The date for each sample is given for Early Uptake (EU) and for Linear Uptake (LU).
f, same sample as Gif-2576.
g, same sample as Gif-2578.

Dates from Jebel el Gharbi indicate that the Dabban persisted there until no later than about 25,000 years ago (Garcea 2004, 33–34). In Cyrenaica, McBurney (1967, 326) believed that it continued at the Haua until about 15,000 years ago, but this was probably not the case. The Dabban is overlain by the "Eastern Oranian", or Eastern Iberomaurusian, and the earliest radiocarbon date that McBurney saw as referring to the Eastern Iberomaurusian was one of almost 13,000 years ago. Two older dates of about 16,000 and 18,600 years ago were on samples taken from the Dabban-Eastern Iberomaurusian interface and were attributed to the Dabban primarily because they fell so far outside the known age-range of the Iberomaurusian. At the time, the earliest date McBurney knew for the Maghrebi Iberomaurusian was about 12,000 BP at Taforalt (McBurney 1967, 215). However, we now know that comparable backed-bladelet industries occur before 20,000 years ago, both in the Nile Valley and in the Maghreb, so that a date of about 18,600 BP in Cyrenaica seems very reasonable. Further, McBurney noted that the Dabban-Iberomaurusian interface was complicated by an artificial pit ("of the kind later associated with the true Oranian" [1967, 161]) excavated into the terminal Dabban layers and that numbers of characteristic Iberomaurusian artifacts had intruded into the Dabban (McBurney 1967, 160–161, Figure I.7). In this case, the only two dates that definitely refer to the Dabban are about 33,100 BP and 28,500 BP (McBurney 1967, Table III.1). These suggest that the Dabban may have disappeared from both Cyrenaica and Jebel el Gharbi at about the same time, and that both areas may have remained unoccupied for several millennia. I note, however, that most of the radiocarbon dates for the Haua were obtained in the mid-1960s and may be problematical. (This is not true of the dates from Jebel el Gharbi.)

The last ten millennia of the Pleistocene in North Africa witnessed a profound change in technology, to one directed almost exclusively toward the production of bladelets, some of which were then backed. The new technology appeared in Nubia and Upper Egypt at about 20,000 years ago (Wendorf and Schild 1989, 804–809), in Cyrenaica by 19,000 years ago, and in the Maghreb before 20,000 years ago at Tamar Hat (Saxon *et al.* 1974) and Taforalt (Roche 1976) (Figure 3.3). At the Haua Fteah, the Eastern Iberomaurusian is so different from the Dabban that McBurney (1967, 327) suggested it might represent an actual change of population; if Cyrenacia was, indeed, unoccupied for several millennia, then he was correct. In the Maghreb, the Iberomaurusian was even more likely to be the work of newcomers, since the region had apparently been unoccupied for about 20,000 years. In each area, this technology remained dominant until the end of the Pleistocene. The Sahara, of course, continued to be as uninhabitable as it had already been for 45,000 years or more.

Relations Between Mediterranean North Africa and the Rest of the Mediterranean

Between 50,000 and 20,000 BP

The above account shows a pattern in prehistory that is somewhat unexpected. Between 50,000 and 20,000 BP, Mediterranean North Africa, from eastern Libya to the Strait of Gibraltar and beyond, was sometimes occupied by *Homo sapiens* and sometimes was not occupied at all. Periods of human occupation by modern human beings could be separated from each other by millennia, particularly in the western part, the Maghreb. This has implications for the role that North Africa played in developments in the Mediterranean basin as a whole during this period.

There is no evidence for significant use of boats in the Mediterranean until much later, in the Final Palaeolithic, when obsidian from the island of Melos appears in the Franchthi (Greece) sequence in the eleventh millennium BP (Perlès 2001, 35). Actual colonisation of Mediterranean islands was generally not accomplished before the Neolithic (Simmons 1999, 18–27). Thus, any contact between Mediterranean North Africa and other coastal areas would have to be overland, eastwards to the Nile Valley and Sinai and northwards into southwestern Asia, which is a very long way, or across the Strait of Gibraltar, which, at least from the western Maghreb, is not far at all.

The Strait of Gibraltar is where the Atlantic Ocean meets the Mediterranean Sea, and differences between the two in tidal amplitude, salinity and temperature can lead to interesting navigational problems; its foul reputation is not entirely undeserved. The shallowest part of the strait is also the most hazardous. The north-south Camarinal Sill creates the greatest internal tides, which, in turn, lead to the massive bore and the greatest turbulence within the strait. At the sill itself, twice-daily, internal (subsurface) vertical displacements of water can be >200 m (Morozov *et al.* 2002) and, because of the much greater depth on the Mediterranean side, the effects of the sill are not symmetrical on the eastern and western sides. Eastwards, into the Mediterranean, the current and waves propagate in opposite directions, so that the bore, wave-breaking and sub-surface turbulence are very strong and remain so beyond the longitude of Gibraltar itself (Morozov *et al.* 2002, 3204–3205). Floating objects cast adrift can be transported in a wide, clockwise arc as far as Mellila (*c.* 170 km) within four days (García Lafuente and Delgado 2004). West of the sill, towards the Atlantic, both current and waves propagate in the same direction, so there is much less turbulence, no bore and little or no wave-breaking (Morozov *et al.* 2002, 3204–3205). This means that although the strait itself is narrow (*c.* 14 km at the narrowest point), the safest crossing is on the Atlantic side, west of 6°W: a distance of 100 km or more. Even today, entirely modern human beings trying to cross from Morocco in small boats do not always make it (Straus 2001, 91).

On the other hand, the narrowest part of the strait is only 14 km wide, so that it is possible to see across it, and most of those setting out from Morocco do get to Spain (Straus 2001, 91 [I am less certain of the relevance of Spanish wind-surfers being blown to Morocco]). It is also possible to play Pleistocene games and consider the strait in the Last Glaciation, when sea-levels were 100 m below those of the present. This would expose a series of small rocky islands, reducing the maximum distance to be crossed over water to about 4 km (Bouzouggar *et al.* 2002, Figure 23). The exposure of these islands is, however, something of a red herring: the islands are the peaks of the Camarinal Sill, which is by far the most hazardous part of the entire strait (Morozov *et al.* 2002). Sea-levels 100 m below those of today would only aggravate the problem. Nevertheless, on balance, I find it difficult to accept that there was no crossing of the Strait of Gibraltar in the Upper Pleistocene, but if there was, the ultimate effect on either side was so small as to be archaeologically invisible.

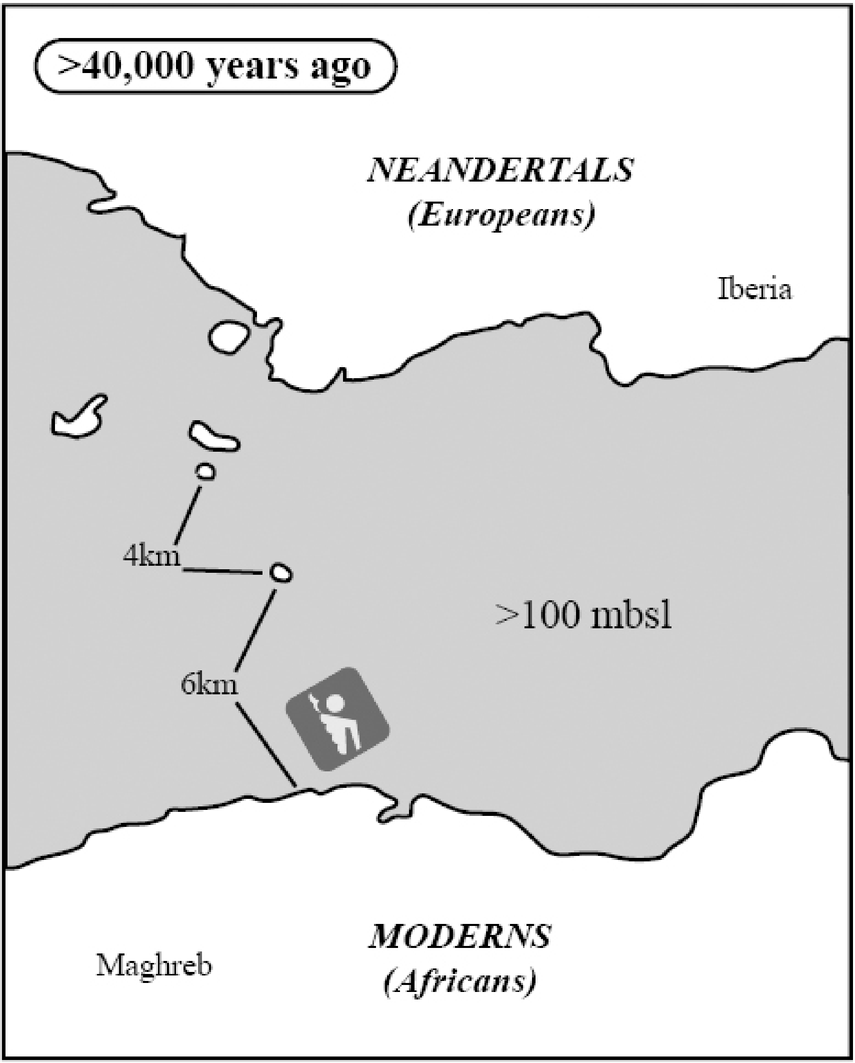

Figure 3.4. Types of humans at the Strait of Gibraltar >40,000 years ago. The coast is drawn at 100 mbsl. (Redrawn from Bouzouggar et al. 2002, Figure 23).

Straus (2001), following a long line of others, has pointed out that, during the period in question, people on the other side of the world had made the much longer sea-crossing to Sahul (Australia and New Guinea), so surely it would have been possible to cross Gibraltar. Hublin (2000, 170), however, makes the important point that crossing to Sahul and crossing the Strait of Gibraltar are very different from each other in ways that go beyond the capability to navigate. When the first people entered Sahul, the continent was completely lacking in hominins and in anything that occupied the hominin niche. They were thus expanding into "empty" territory with no direct competition. However, if moderns crossed northward into Iberia, they would have found the hominin-niche already occupied by the Neandertals (and, of course, vice versa); the territory was not "empty". In this case, moderns would have left a detectable archaeological signature in Iberia only if they invaded in large numbers (Hublin 2000, 170). It is not difficult to accept that there was not an invasion across the Strait of Gibraltar.

It would also have required a "massive invasion" from North Africa if the moderns were to leave a genetic signature in Iberia (Hublin 2000, 170–171). Global comparisons of mitochondrial DNA have clearly shown that the Neandertals were genetically separate from our species as a whole and had been for (at least) half a million years (Krings *et al.* 1997, 2000). What is more interesting in the present context is genetic comparison of modern indigenous populations in Iberia, in the rest of Europe, and in North Africa. The various modern populations of Iberia as a whole share a common ancestry within the period of the Upper Palaeolithic (Corte-Real *et al.* 1996), and they are, genetically, much more closely linked to other West European populations (French, Bretons and Swiss) than they are to North Africans (Comas *et al.* 2000, Figure 3.5). This means that the Strait of Gibraltar has been a very strong genetic boundary, separating Iberia from North Africa, probably not just because of difficulty in navigating the Strait but also arising from cultural differences (Comas *et al.* 2000, 316–317). I note that this is the genetic pattern of living populations, so that a reluctance to cross the Strait has nothing whatsoever to do with the issue of "modernity". In any case, southern Europe and North Africa saw two independent, but parallel, colonisations by modern human beings (Comas *et al.* 2000, 317). Finally, when populations in the eastern Mediterranean are also included in the mix, the main indigenous North African cluster (U6, the "Berber cluster") and the oldest European-specific cluster (U5) "…diverged from a common ancestor…in the Near East…~50,000 years ago and spread along the north and south coasts, respectively, of the Mediterranean" (Macauley *et al.* 1999, 245).

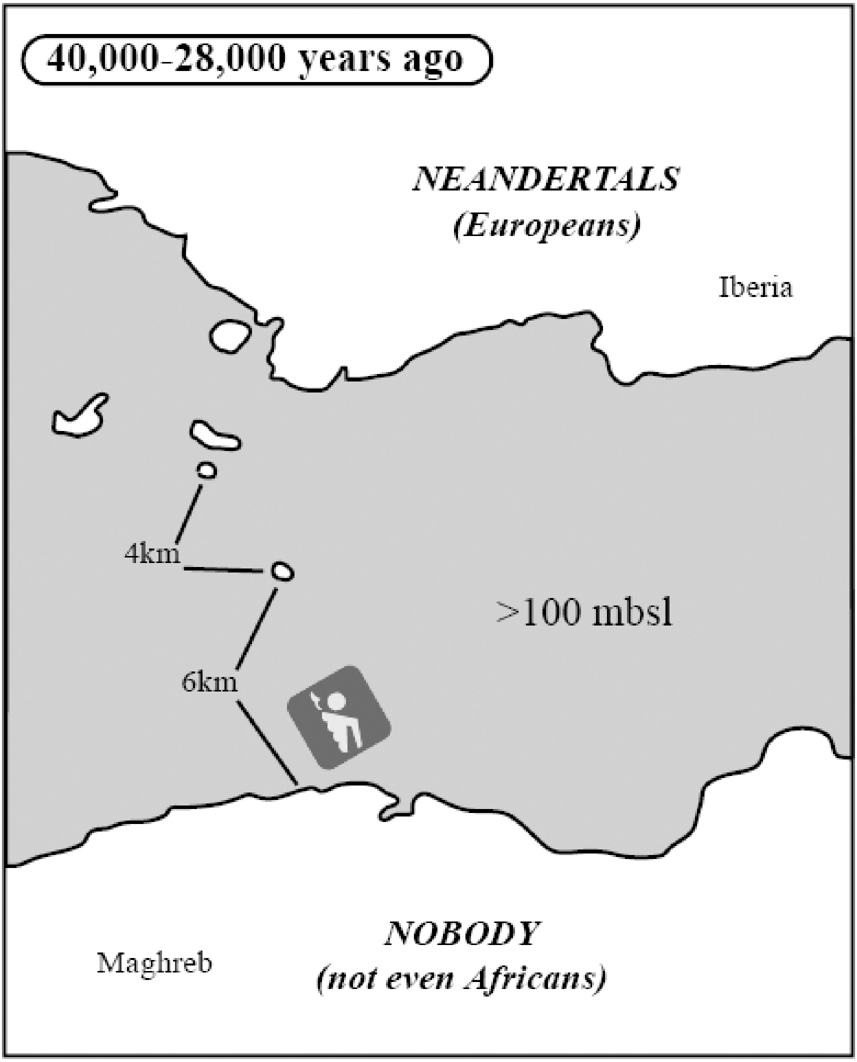
40,000-28,000 years ago
NEANDERTALS
(Europeans)
Iberia
4km
6km
>100 mbsl
Maghreb
NOBODY
(not even Africans)

Figure 3.5. Types of humans at the Strait of Gibraltar 40,000-28,000 years ago. The coast is drawn at 100 mbsl. (Redrawn from Bouzouggar et al. 2002, Figure 23).

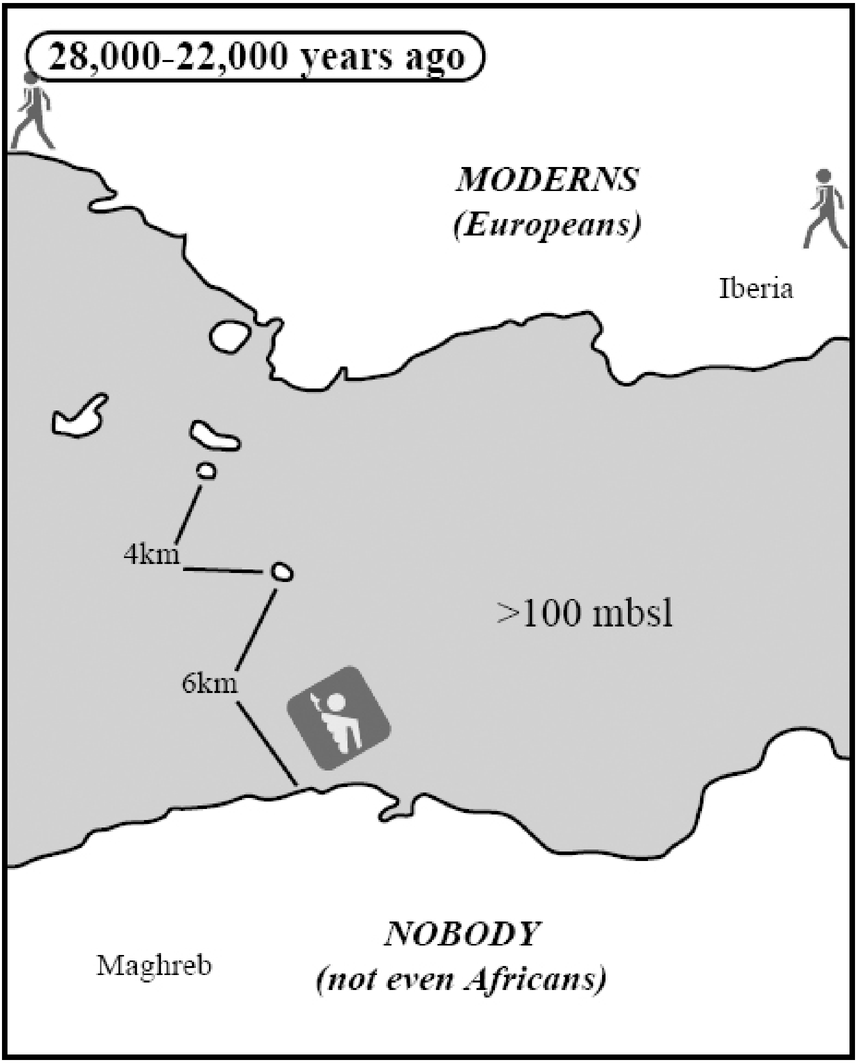
28,000-22,000 years ago
MODERNS
(Europeans)
Iberia
4km
>100 mbsl
6km
NOBODY
(not even Africans)
Maghreb

Figure 3.6. Types of humans at the Strait of Gibraltar 28,000-22,000 years ago. The coast is drawn at 100 mbsl. (Redrawn from Bouzouggar et al. 2002, Figure 23).

The permanent colonisation of southern Iberia by moderns was from the North, but the dating of it has become less clear than it was. An age of 30,000–27,500 years ago has been suggested (Bocquet-Appel and Demars 2000, 549–551), but this has been based in part on a date for the "Aurignacian" from excavations at Gorham's cave (Gibraltar) during the 1950s (Waechter 1964). The suggestion is now almost totally based on this date, as other claims become discredited (Straus *et al.* 2000, 557–559). Further, recent re-excavation of the cave has shown that the Mousterian is directly overlain by Solutrean and that the boundary between the two is "sharp and clear" – that is, the Mousterian level was not contaminated by the Solutrean (Finlayson *et al.* 2006, 851). Thirty AMS dates on individual pieces of charcoal show that the Mousterian endured until about 28,000 years ago, and possibly even until about 24,000 years ago, while the oldest date for the Solutrean is about 18,400 years ago. It seems unlikely that southern Iberia was depopulated for some ten millennia after the demise of the Neandertals, but the presence of moderns in the region may have been somewhat sporadic.

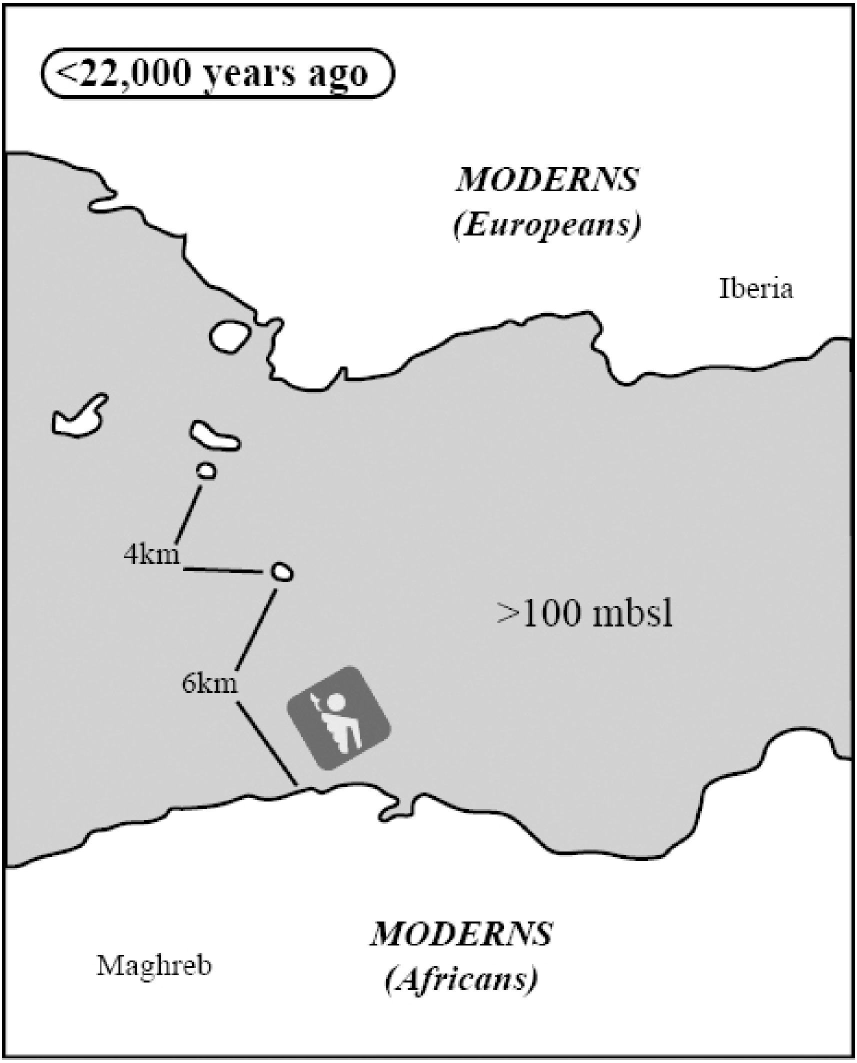
<22,000 years ago
MODERNS
(Europeans)
Iberia
4km
>100 mbsl
6km
MODERNS
(Africans)
Maghreb

Figure 3.7. Types of humans at the Strait of Gibraltar <22,000 years ago. The coast is drawn at 100 mbsl. (Redrawn from Bouzouggar et al. 2002, Figure 23).

Looking at human occupations of the northern and southern sides of the Strait of

Gibraltar diachronically, we find that: before 40,000 years ago, there were Neandertals in Iberia and moderns in the Maghreb (both making "Middle Palaeolithic" artifacts) (Figure 3.4); between about 40,000 and 28,000 years ago, there were still (Middle Palaeolithic) Neandertals in Iberia (Zilhão and d'Errico 1999, 53), and perhaps even as recently as 24,000 years ago at Gibraltar itself (Finlayson *et al.* 2006); but there seems to have been no-one in the Maghreb (Figure 3.5); between about 28,000 and 22,000 years ago, there were (Upper Palaeolithic [Straus 2001, 95]) European moderns in northern Iberia, and there may have been moderns in southern Iberia (Zilhão and d'Errico 1999, 53), but there was still no-one in the Maghreb (Figure 3.6); and after about 22,000 years ago, there were modern Europeans in Iberia and modern Africans in the Maghreb (Figure 3.7).

In sum, in the period from 50,000 to 20,000 years ago, Iberia was (more or less) continuously occupied by Neandertals and then by (European) moderns, for both of whom Iberia was the principal southern refugium during cold periods (Gamble *et al.* 2004, 247–249), while the Maghreb was unoccupied from 40,000 to 22,000 years ago. Even in those periods when both sides of the Strait of Gibraltar were occupied, the Iberians and the Maghrebis has nothing to do with each other – or rather, so little (at most) as to leave no archaeological or genetic trace. This may be, in part, why the Neandertals were able to survive for so long in extreme southern Iberia.

An Insular View of the North African Mediterranean Coast

We know that modern people are everywhere (Gamble 1994), and that modern people had evolved in Africa long before 50,000 years ago, so how could large parts of North Africa be empty of people for tens of millennia? If, through some misfortune, a local population of moderns became extinct, why was the area not immediately recolonised by other moderns, whom we expect to abhor a vacuum almost as much as Nature does? I suggest that our expectations are incorrect because we see Mediterranean North Africa wrongly.

Our view of Mediterranean North Africa is historically European, even Eurocentric. We see North Africa as just another part of the Mediterranean coast, drier than but still, in essence, similar to other parts of the Mediterranean coast: the interface of sea and habitable land, both of which extend far back beyond the interface. But this is not so. The last people to see Mediterranean North Africa through non-European eyes were the Arab invaders, beginning in the seventh century AD, who saw it through Arabian eyes. They found what is now Tunisia, northern Algeria and Morocco to be so isolated by the Mediterranean on one side and the great Sahara Desert on the other, that they named it, "el Jezirat el Maghreb": the Islands of the West (Vaufrey 1955, 9). However, isolation between the Mediterranean and the Sahara is true of almost the entire coast of North Africa, which can thus be usefully thought of not as a linear phenomenon where the sea meets dry land, but as a series of islands (Shaw 2003, 98). Mediterranean North Africa consists of a series of small, habitable areas, which are surrounded and separated by very large uninhabitable areas, and, in North Africa, the prime determinant of whether an area is habitable or not is the availability of drinking water. Thus, the islands have fresh water and the areas between them do not. In this respect, there is no difference between a complete lack of water and a complete presence of salt-water: neither of them permits drinking.

Figure 3.8 depicts Mediterranean North Africa as a series of islands. The boundary between the desert and the sea is deliberately blurred because its precise location is not crucial, and the islands remain insular no matter what the sea-level. Almost the entire 2500–km-long coast, from the Nile to the Gulf of Gabès, is "a narrow margin of extremely arid steppe. Surface water is here available at most for a few weeks in the year" (McBurney and Hey 1955, 5). In the east is the very long island of the Nile Valley. There is little to no local rainfall and the island is maintained, instead, by rainfall in the East African highlands. The second island is >700 km to the west in Cyrenaica, named in Arabic, "el Jebel el Akhdar": the green mountain, where orographic rainfall ranges between 200 and 550 mm per annum and, at least in the west and in the upland, there are some perennial springs (McBurney and Hey 1955, 12). Historically, connexions from Cyrenaica have been eastwards (Evans-Pritchard 1954, 47; Shaw 2003, 99).

The third island is, again, >700 km away in Tripolitania, in Jebel el Gharbi. The separation of Jebel el Akhdar and Jebel el Gharbi is, if anything, more profound than that between Jebel el Akhdar and the Nile. The overland route around the Gulf of Sirte (Sidra) has been called, "without dispute one of the most decided frontiers, natural or human, to be found anywhere in the world" (Evans-Pritchard 1954, 47). This is echoed by Shaw (2003, 99), "in antiquity this was renowned as an arduous and treacherous journey". There is some rainfall in Jebel el Gharbi, but, more importantly, there are springs, some of them perennial, fed by the continental aquifer. It is then several hundred more km until one begins to encounter the rainfall characteristic of the Maghreb, at about the Gulf of Gabès.

During the wet phases of prehistory, the "island" metaphor was not applicable to Mediterranean North Africa, and most of what is now true desert was occupied. From time to time, Cyrenaica, Jebel el Gharbi and the Maghreb were easily accessible from the rest of North Africa, until the final onset of aridity at no later than 65,000 years ago, and all three were occupied immediately prior to that time by modern humans making Middle Palaeolithic artifacts. However, by twenty-five thousand years later, human occupation had ceased in the Maghreb, had probably ceased in Jebel el Gharbi and perhaps also in Cyrenaica.

We must conclude that, in each area, modern humans became locally extinct. After the onset of the final Pleistocene aridity, contact between the three areas is very unlikely, and each would become isolated. The Maghreb, in particular, is a large area with a "Mediterranean climate" and might be expected to support a viable population, except that this is true of only a minor part of the region: the coastal plain and the northern piedmont of the Atlas, which, today, are 10–50 km wide (Vaufrey 1955, 9). Beyond the first range of the mountains are the High Plains: a dry steppe with <300 mm of rainfall per annum and a very unstable climate, that, for most of the year, is scoured by desiccating winds from both North and South (Vaufrey 1955, 9–10). Under "natural conditions", large animals (including people) that were not specifically adapted to the desert would spend winter on the High Plains and summer on the coastal plain and northern piedmont (McBurney 1960, 81–83). Further, marine records from the western Mediterranean show that there were particularly abrupt changes in temperature during OIS 2, OIS 3, and OIS 4, and that they were much more frequent than in OIS 5 and OIS 6 (Martrat *et al.* 2004). In an egregious instance at the end of OIS 5, sea surface temperatures rose by 10.5°C in 1000 years and then cooled by -7.7°C in the following 2800 years (Martrat *et al.* 2004, 1764). Under such conditions, extinction of an isolated group even of modern humans becomes conceivable. Similar arguments can be made for Jebel el Gharbi, with the aggravating factor that it is a much smaller area than the Maghreb.

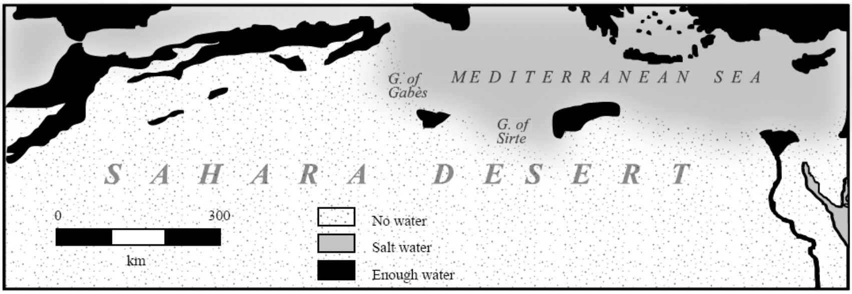

Figure 3.8. Mediterranean North Africa as a series of islands.

Local extinction seems less likely for Cyrenaica. In the nineteenth century, the population of Cyrenaica was about 250,000 (Evans-Pritchard 1954), but they were almost entirely sustained by domestic animals and some cultivation of cereals. McBurney and Hey (1955, 13) thought that the Gebel el Akhdar could have supported about 2000 foragers. This could be a viable population, and the archaeological record suggests that there may not have been a major break in occupation between the Mousterian and the Dabban, both of which were the product of modern humans. In terms of artifacts, there is no transition between the Mousterian and the Dabban, but, rather, an abrupt break. We do not know what this means in terms of people.

Although the islands of North Africa are so defined because of the lack of fresh water, the presence of the Mediterranean and the absence of boats also meant that any travel between them had to be overland. Those who have made the journey ("arduous and treacherous" [Shaw 2003, 99]) in historical times have done so with considerable support from domestic animals, which carried supplies (especially water) whether or not they were also ridden. Twenty thousand years ago, there were no domestic animals and people had themselves to carry everything they would need, especially water. This is quite apart from how they might know that there was a place to go to beyond an apparently never-ending desert.

Nevertheless, inter-island journeys were sometimes made successfully and islands could be recolonised for periods of millennia. Thus, about 40,000 years ago, the makers of the Dabban reached Cyrenaica from the east and remained there until well after 30,000 years ago. Their descendants (presumably) can be seen as far west as Jebel el Gharbi by about 30,000 years ago and that area was occupied until about 25,000 years ago. But they seem not to have gone still farther west and into the Maghreb. The final and complete colonisation of the islands began somewhat more than 20,000 years ago, with the makers of the Iberomaurusian and other backed-bladelet industries, and modern humans beings have occupied all of the islands ever since then.

Many more millennia were to pass before occupants of the Maghreb overcame the cultural and technological barriers which inhibited contact across the Strait of Gibraltar, and more still before the islands east of the Nile Valley began to have contact with the rest of the Mediterranean world. In this respect, Cyrenaica, Jebel el Gharbi and the Maghreb were very much like the other isolated parts of the Mediterranean, such as Corsica, Sardinia, Crete and Cyprus: islands, every one of them.

An Afterthought

Consideration of any part of the western Old World between 50,000 and 25,000 years ago (or 20,000 in this case) is expected to address what was involved in the change from Middle to Upper Palaeolithic and how this came about. In most, if not all, of Mediterranean North Africa west of Egypt, there was a Middle-Upper Palaeolithic hiatus of at least several millennia and Middle and Upper Palaeolithic people had absolutely nothing to do with each other. Consideration of late Middle and Upper Palaeolithic in any part of the western Old World is, in turn, expected to address the issue of "modernity": what it means to be a "modern human being", especially, if not entirely, in terms of behaviour. I choose not to do that. The makers of the late Middle Palaeolithic were anatomically modern humans, as were also the makers of the Upper or Late Palaeolithic; there is no obvious reason to assume that there were major differences between them in behaviour. They were all limited to a Stone-Age technology; they all lived in isolated islands along the Saharan-Mediterranean interface; they very rarely stepped beyond their own island; and they all made a living based upon wild plants and wild animals. No-one doubts that the Upper Palaeolithic people were modern in behaviour, and I can find no reason to doubt that the late Middle Palaeolithic people were also modern in behaviour. The burden of proof falls, I believe, on those who would assert that some modern people were not really modern people after all.

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4. The evolutions and revolutions of the Late Middle Stone Age and Lower Later Stone Age in north-west Africa

Elena A. A. Garcea

ABSTRACT

The transition from the Middle Palaeolithic/Middle Stone Age (MSA) to the Upper Palaeolithic/Later Stone Age (LSA) is particularly interesting in North-West Africa because it displays some peculiar dynamics that do not find precise parallels either inside or outside Africa. This region is in a significant geographic position, being adjacent to the main Out of Africa corridor connecting East Africa with the Levant.

Most modern human aspects, anthropological as well as behavioural, are not really "revolutionary" components of the LSA. Morphologically modern types existed since the Early MSA and modern behaviour appeared in numerous forms during the Aterian, the typical Late MSA of North Africa. Thus, the transition to the LSA followed an "evolutionary", rather than "revolutionary", path in these terms. On the other hand, "revolutions" regarding behavioural patterns did occur during the Aterian, but earlier, and minor, basically technological, "revolutions" took place in patchy evidence during the Lower LSA.

North-West Africa, and especially North-West Libya, provides new data on the evolutions and the revolutions that happened before and at the MSA-LSA transition. In order to better understand their impact on the succeeding populations, they are presented and discussed separately according to the chrono-cultural periods of their appearance (Late MSA and Lower LSA). Furthermore, they are related to various potentially influential factors, including Maghrebi, East African and Levantine contacts, as well as replacement vs. continuity issues, and environmental and climatic agents.

Preamble

Archaeological research in Northern Africa has received less attention than in other regions of the Mediterranean. However, there are numerous sites on the African coast, covering almost half of the entire Mediterranean littoral, and therefore they can not be excluded from the general debate. Although the Out of Africa movements of different *Homo* species did not originate in Northern Africa, this strip of land acted as a corridor in the dispersals towards more northerly and easterly regions. Northern Africa did not only play a role during its crossings by various *Homo* species on their way to colonize Europe and Asia. As part of the Mediterranean basin, Northern African populations have shared similar environmental and climatic conditions with the other human groups facing the same sea. Yet, they have often kept their own cultural specificities.

This chapter discusses and sums up similarities and differences, and distinguishes Northern Africa features vis-à-vis the rest of the Mediterranean, aiming to provide a complementing useful contribution to this comprehensive review of the Middle/Upper Palaeolithic of the Mediterranean basin.

Revolutions and Evolutions

The period between 50,000 and 25,000 years BP highlights the transition from the Middle Palaeolithic to the Upper Palaeolithic in Europe, the Near East, as well as Northern Africa. However, if this shift may have been a “revolutionary” event in some parts of the world, it was not quite a revolution in Northern Africa, as many “revolutionary” actions had already occurred, as will be described and discussed in the following pages. In order to point out regional peculiarities, specific African terms, Middle Stone Age (MSA) and Later Stone Age (LSA), are preferred in this paper.

Before examining the various “revolutionary” and “evolutionary” aspects of the MSA/LSA transition in Northern Africa, and before comparing them with respect to other geographic areas, it is necessary to clarify the meaning of “revolution” and “evolution”. Bar-Yosef (1998, 142) defines “revolution” as a crucial transition that reaches a ‘point of no return’ and leads to a new socio-economic system. He also remarks that revolutions imply the emergence of new technology in a core area and its dispersal by either migration or diffusion (Bar-Yosef 2000a, 24). As these conditions occur in the transition from the Middle to the Upper Palaeolithic in the Near East, he maintains that it is a revolution. I concur with Bar-Yosef’s idea of revolution as a no return change, and I would further elaborate the definition of revolution as a shared behavioural change creating new permanent conditions. New technology, in my opinion, is a possible side effect, rather than a direct consequence. Behavioural transformations accepted and shared by an entire group are the key factor as the group, and only the group, is capable of preserving the new status quo.

On the other hand, “evolution”, from a cultural viewpoint, is a continuing, slow process of gradual changes in current practices with manifestation of novel traits (cf. Sahlins and Service 1960; Harris 1979). Compared to revolutions, evolutions are less radical, less pervasive, and patchier. They are neither irreversible nor unilinear. As evolutions are slower, it is more difficult to trace their time frame, with their beginning and end.

Prehistoric populations in Northern Africa have been engaged in many revolutions and many evolutions. Among them, the MSA/LSA transition exhibits numerous distinctive features from both types of processes, some being gradual developments of processes that had already taken place during the MSA (evolutions), others being drastic changes from the past (revolutions). In order to analyse them thoroughly, I shall first present the evolutionary continuities and the revolutionary shifts that characterise the Late Middle Stone Age, and then those typifying the Lower Later Stone Age. Finally, I shall provide an African perspective to the interpretation of the Mediterranean archaeological records.

The Late Middle Stone Age

Evolutions in the Late Middle Stone Age-Aterian

The Middle Stone Age of Northern Africa includes two main techno-complexes, an earlier one, comprising a generalised "Middle-Palaeolithic-like" technology, which corresponds to the Early MSA, and a later one, represented by the typical North African Aterian. The Aterian techno-complex has a wide geographic distribution in Northern Africa with the exception of the Nile Valley. It is a Levallois-based industry with a blade component and "Upper Palaeolithic" types, namely endscrapers, burins, and perforators. Some tools or even unretouched blanks exhibit stems or tangs at their base. Bulbar basal thinning and bifacial retouching are also typical.

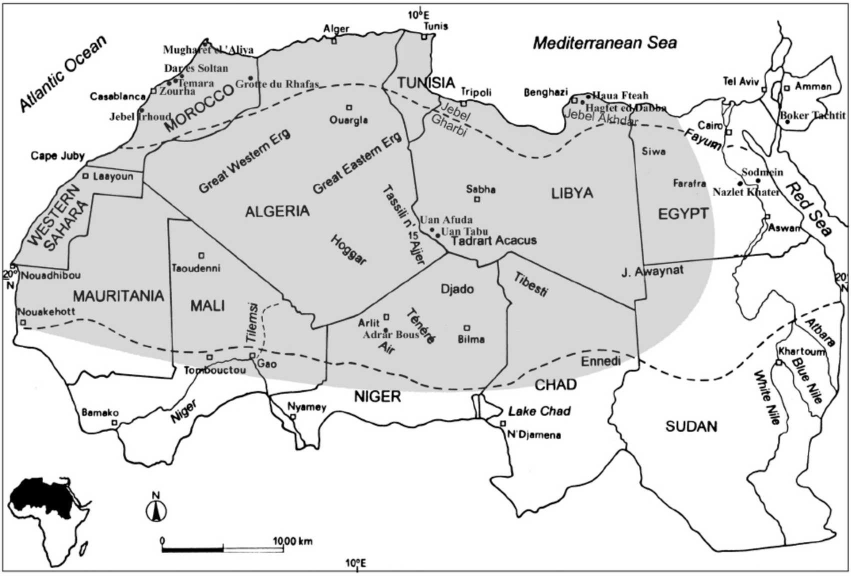
As far as Europe is concerned, it has also been recently re-stated (Davies and Gollop 2003) that the Mousterian, i.e. Middle Palaeolithic, is associated with Neanderthals, and the Aurignacian and the Gravettian, i.e. Upper Palaeolithic, are related to anatomically modern humans. The picture in Africa is quite different. Cranial and post-cranial remains of late archaic or early modern *Homo sapiens* were found at Jebel Irhoud (Morocco) and have been recently dated to an age within OIS 6, spanning between 130,000 and 190,000 years BP (Grün and Stringer 1991). These human remnants are comparable to the Skhul-Qafzeh group from the Levant, but appear slightly more primitive and possibly older, suggesting an ancestor-descendant relationship with late Upper Pleistocene modern humans (Hublin 1993, 2000; Lewin and Foley 2004; Marean and Assefa 2005). The Irhoud samples display affinities with two mandibular fragments found at Haua Fteah, in Cyrenaica (Libya), which are now assigned to, or even before, OIS 6 (Hublin 2000). Both the Jebel Irhoud and the Haua Fteah hominids produced Early MSA techno-complexes.

Human fossils associated with Aterian techno-complexes were only found in Morocco, at Temara, Dar es Soltan, and Zouhra (El Haroura), just north of Jebel Irhoud (Figure 4.1). Compared with the samples from Jebel Irhoud, the Aterian human remains are morphologically more advanced, showing fully modern attributes (Hublin 1993), but early modern humans in Northern Africa appeared before the Aterian industrial complex, and date from at least 130,000 years BP.

The first finite date obtained for the Aterian came from Haua Fteah (Libya) and gave an age of 47,000 ± 3,200 years BP, which McBurney (1967) considered as a minimum age for the Aterian. Recent radiometric dating (conventional ^{14}C, AMS radiocarbon, OSL, TL, ESR, U/Th) confirm McBurney's interpretation, indicating all ages for the Aterian $>$40,000 years BP. In the western Maghreb, ESR dates on tooth enamel samples from Mugharet el 'Aliya (Morocco) provided EU ages ranging from 39,000 ± 4000 to 44,000 ± 5000 years BP and LU ages from 47,000 ± 5000 to 56,000 ± 5000 years BP for the upper level, and from 62,000 ± 6000 (EU) and 81,000 ± 9000 (LU) for the lower level (Wrinn and Rink 2003). At Grotte du Rhafas (Morocco), isotope and TL datings spanned between 60,000 and 80,000 BP (Wengler *et al.* 2006).

In the eastern Maghreb, in the Jebel Gharbi (Libya), U/Th dating of calcareous crusts on top and below silts with Aterian artefacts gave ages between $>$43,000 and $<$85,000 BP, respectively. Radiocarbon dates confirmed the youngest ages, giving 43,530 ± 2110 years BP at Ain Shakshuk and 44,600 ± 2430 BP at Wadi Sel (Figure 4.2). According to the general geomorphological series, the Aterian in this region is mainly associated with OIS 3 (Barich *et al.* 2003a, b, 2006; Garcea 2004a;

Giraudi 2005).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Atlantic Ocean
Mugharet el 'Aliya
Dar es Soltan
Temara
Zourha
Grotte du Rhafas
Casablanca
Jebel Irhoud
MOROCCO
TUNISIA
Tripoli
Benghazi
Haua Fteah
Hagfet ed Dabba
Jebel Akhdar
Jebel Gharbi
Tel Aviv
Amman
Boker Tachtit
Cairo
Fayum
Siwa
Ouargla
Cape Juby
Laayoun
WESTERN SAHARA
Great Western Erg
Great Eastern Erg
ALGERIA
Tassili n' Ajjer
15
Hoggar
Sabha
LIBYA
Farafra
Sodmein
Nazlet Khater
EGYPT
Red Sea
Aswan
Uan Afuda
Uan Tabu
Tadrart Acacus
20° N
Nouadhibou
Taoudenni
MAURITANIA
MALI
Djado
Tibesti
J. Awaynat
Nouakchott
Tilemsi
Arlit
Adrar Bous
Ténéré
Aïr
Bilma
Atbara
Khartoum
Blue Nile
White Nile
Tombouctou
Gao
Ennedi
NIGER
CHAD
Bamako
Niger
Nyamey
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Figure 4.1 Estimated extent of the Aterian with sites cited in the text.

In the Central Sahara, at Uan Tabu in the Tadrart Acacus mountain range (Libyan Sahara), the upper sequence of a 100 cm thick Aterian deposit was dated by the OSL method to 61,000 ± 10,000 BP (Martini *et al.* 1998; Garcea 2001). The age of the Aterian was confirmed by other measurements made by the TL method, giving ages of 70,500 ± 9500 and 73,000 ± 10,000 years BP, and by the OSL technique to 69,000 ± 7000 BP, from Uan Afuda, in the same mountain range (Cremaschi *et al.* 1998; Martini *et al.* 1998). In the Adrar Bous (Southern Sahara, Niger), the geological sequence associated with the Aterian was approximately dated between ≥ 40,000 and ≤ 150,000 BP (Williams in press).

The biological record, as well as the archaeological and stratigraphic evidence especially at Moroccan sites, support continuity between the makers of Early MSA industries and those producing Aterian assemblages (Wengler 1997; Hublin 2000). By the time of the shift from the Early MSA to the Aterian cultural complexes, fully modern humans had long appeared in Northern Africa. Early morphologically modern *sapiens* did not appear with the Aterian, and – even less so – with the Later Stone Age, but earlier, with the Early MSA.

The origin of modern humans in Northern Africa clearly contrasts with that in Europe as it did not occur in combination with a technological change; it also contrasts with that in the Near East as fully modern humans appeared earlier and more systematically all over the Maghreb and the Sahara, as indicated by the numerous Aterian sites. Furthermore, some technological features that typify Neanderthals in Eurasia, such as the use of the Levallois core reduction method and the production of typical Middle Palaeolithic tools (e.g. sidescrapers, points, and denticulates), continued to be in place throughout the evolutionary path of

North African early modern humans, into at least the early, if not entire, Aterian period.

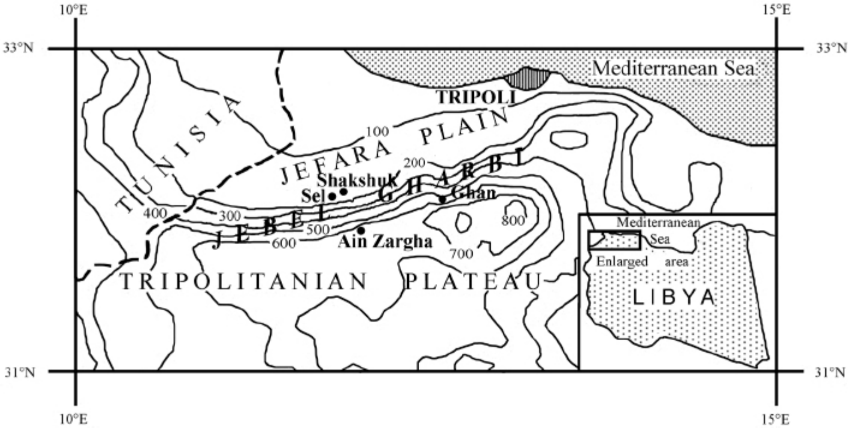


Figure 4.2 The sites in the Jebel Gharbi cited in the text.

Revolutions in the Late Middle Stone Age-Aterian

Several behavioural revolutionary innovations occurred with the onset of the Aterian. They took place while the biological evolution of modern humans was already accomplished during the Early MSA, and while some technological continuity persisted with the long-lasting, but not everlasting, Levallois technique. Changes include major technological innovations, exploitation of a wide range of food resources and raw materials, new site organisations, and new settlement systems (cf. Garcea 1998b).

The peculiar technological feature of the Aterian is the production of tangs on both retouched tools and unretouched blanks (Figure 4.3, 1–4). Some tangs may have been manufactured to be mounted or hafted on supports made of other materials, such as wood. However, not all tanged tools were hafted on spear shafts, as tangs could also have been the working parts of hand-held tools (Clark in press). In fact, tanged tools did not necessarily serve hunting purposes or other functions related to meat consumption, such as butchering or hide scraping. They could have been used, for example, as digging sticks for the exploitation of carbohydrate-rich tubers (Gifford-Gonzalez *et al.* in prep.). At any rate, whatever their uses, their identification with the Aterian (Tixier 1958–59, 1967; Bordes 1961) is inadequate as there are Aterian assemblages without tanged tools (see, *e.g.* Clark 1982; Kleindienst 1998; Garcea 2006a).

Tanged pieces were only one of the components of the new diversified tool-kits, which included tools elsewhere known as typical Upper Palaeolithic products, such as endscrapers (Figure 4.3, 5), burins (Figure 4.3, 6), and perforators (Figure 4.3, 7). There are no precise chronological indications as to when these tools appeared in the Aterian tool-kits, although they seem to characterise late Aterian assemblages, at least in the Jebel Gharbi (Libya). At the Jebel Gharbi sites, the production of these new tools is concurrent with the abandonment of the Levallois technique which is replaced by opposed and single platform core striking methods

(Garcea 2006a).

Bifacial flaking employed to produce foliates (Figure 4.3, 8) is another typical Aterian trait. Bifacial foliate points may be even more numerous than tanged tools as in the case of the Adrar Bous, in the Southern Sahara. Like tanged tools, lanceolate points could have been mounted on thrusting spears, but they could have also been used as hand-held knives. Bifacial lanceolates and core-axes are particularly significant from a geographic and cultural point of view as they indicate affinities with the Lupemban industrial complex in the Congo basin to the south (*e.g.* Clark 1982, 1993; Kleindienst 1998; Garcea 2001, 2004a). As a matter of fact, they significantly occur on the highlands surrounding the Lake Chad basin, in the Adrar Bous, the Djado plateau, the Tibesti, and the Ennedi (Tillet 1983; Gifford-Gonzalez *et al.* in prep.). Their distribution seems to be concentrated in the southern part of the Sahara, which was more open to south-eastern influences.

Tool variability developed together with the use of previously unexploited raw materials, including fine grained rocks, petrified wood, silicified vitric tuff, flint, chalcedony, and quartzite, which granted more accurate tool manufacturing. Even though many rocks were from a maximum distance of 10–20 km, some raw materials were imported from considerable distances (Wengler 1990, 1995, 1997; Clark 1993; Garcea 2004b). Their selection indicates a wide knowledge of the raw materials' location and knapping potential, and their procurement required a certain degree of regional mobility and organisation of long-distance movements. Furthermore, the increased knowledge of the manufacturing potentials of the different rocks and their availability over a wide territory was extended to raw materials other than rocks, such as wood and especially bone (El Hajraoui 1994; Marean and Assefa 2005).

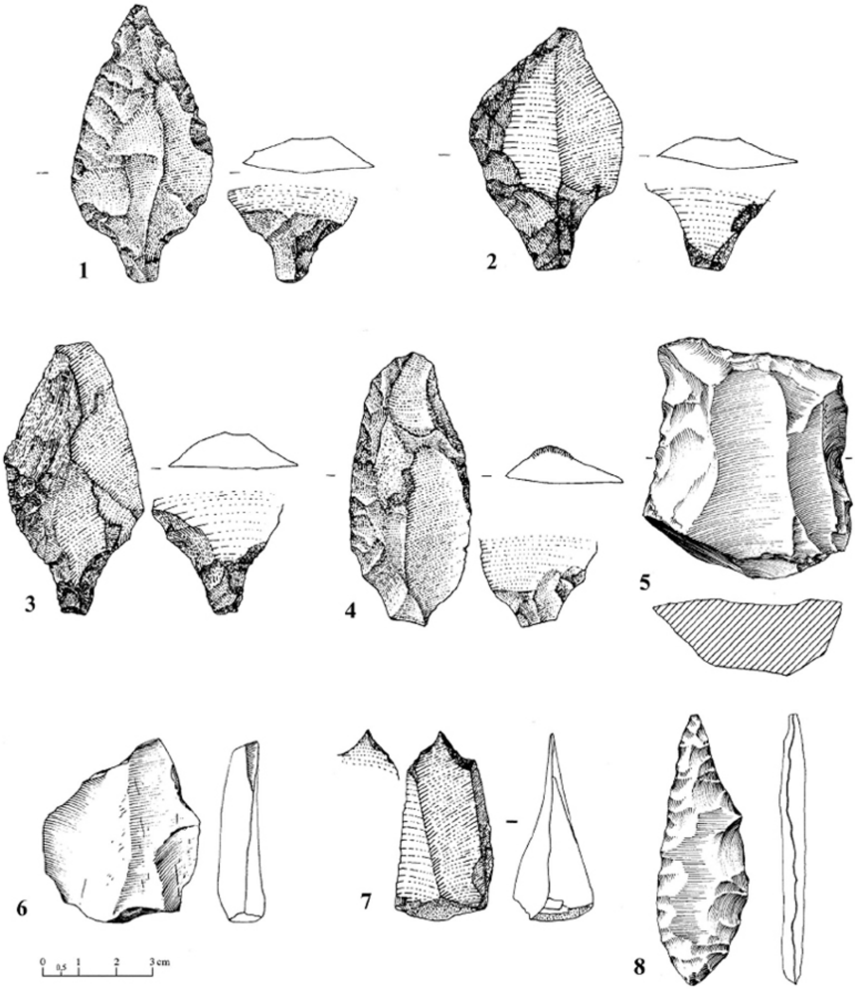


Figure 4.3 Aterian tools: 1–4. Tanged tools (Uan Tabu); 5. Endscraper (Adrar Bous); 6. Burin (Adrar Bous; 7. Perforator (Uan Tabu); 8. Bifacial foliate (Adrar Bous).

Habitation structures including slabs, wedging elements, pole holes, fences, and hearths were found at different sites in Morocco (Debénath 1992), and a 1–m thick occupational deposit was excavated in the rockshelter of Uan Tabu (Libya), indicating continual frequenting of the same site (Garcea 1996, 1998a, 2001). Investments in architectural structures, intra-spatial organisation, and continual occupation of some sheltered sites show that Aterian groups developed skills of self-sufficiency and a good degree of sedentism.

J. D. Clark (1983) suggested that reserve resources and some food surplus were accumulated at main sites, allowing a less opportunistic organisation. Moreover, the use of hearths may have required longer preparation of food, but also provided better assimilation of nutritional values. On the other hand, there remained several other smaller seasonal sites in the Sahara located near ephemeral water supplies and/or raw material outcrops, suggesting that Aterian groups kept some flexible and opportunistic sites which may have granted their adaptation and favoured their expansion when environmental conditions became less sustainable in the desert (Marks 1975; Wengler 2001).

Where it was possible, animal proteins were not only obtained by hunting mammals, but also by fishing and fowling as the location of some sites near water resources indicate. Sea resources, including those in the Mediterranean coast, began to be exploited beginning in Aterian times. Zooarchaeological remains of fish were found at Dar es Soltan (Ruhlmann 1951) and fish and monk seal were found at Mugharet el 'Aliya (Arambourg 1967).

Of all Aterian behavioural revolutions, the newly adopted settlement system is probably the most outstanding event. Recent geoarchaeological research on the late Upper Pleistocene in the Jebel Gharbi, eastern Maghreb (Libya), showed that Aterian people implemented a new settlement pattern correlated to a series of water springs spread all along the Jebel Gharbi. The origin of the springs was due to tectonic faults that produced ground displacement and water outlets during earthquakes in the Late Pleistocene. Aterians established their sites at various locations along the fracture field. Their settlement system and water resource exploitation strategy was so successful that it remained in use in later periods, through the Later Stone Age, Iberomaurusian, Neolithic, Roman age, and until the present time. The water supply of some of these springs has been so regular that it can still sustain the present settlement system (Giraudi 2005; Garcea and Giraudi 2006).

The Lower Later Stone Age

The Dabban

There is very limited evidence for the Lower Later Stone Age in North-West Africa (Figure 4.4). It is not known in the classic Maghreb, from Mauritania to Tunisia, whereas it is attested to in northern Libya. The first place where it was recognised is Hagfet ed Dabba, in the Jebel Akhdar (Cyrenaica, eastern Libya), which became the type site of the Dabban, or Dabba culture (McBurney and Hey 1955). The excavation at the Haua Fteah cave, at the foot of the same mountain range, unearthed a long stratigraphic sequence comprising numerous layers (from Layer XXV to XVI) with Dabban artefacts on top of a "Middle Palaeolithic" deposit and below an "Eastern Oranian" (Iberomaurusian, Upper LSA) horizon (McBurney 1967). McBurney defined the Dabban as a blade industrial tradition following "Middle Palaeolithic" techno-complexes (McBurney and Hey 1955; McBurney 1967). He distinguished two phases, Early and Late, within the Dabban.

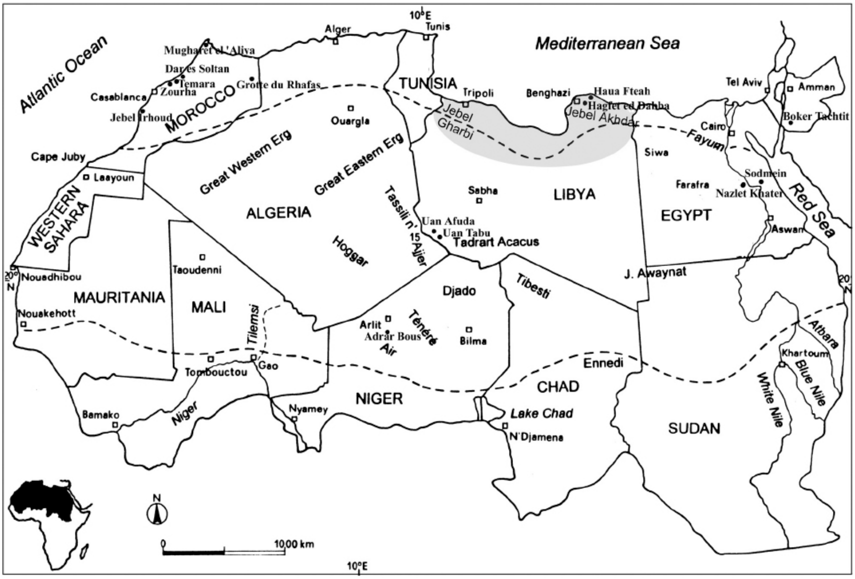
There are some radiocarbon dates for the Dabban. The earliest ones are 43,400 ± 1300 BP from Haua Fteah (cf. the discussion by Marks 1975, 443) and 40,500 ± 1600 BP from Hagfet ed Dabba. The Late Dabban started around 32,000 years ago and was radiocarbon dated from 33,100 ± 400 BP and 28,500 ± 800 BP at Haua Fteah, lasting until *c*. 20,000 BP (McBurney 1967).

For the time being, the Dabban seems to be an industry peculiar to Cyrenaica, displaying a chronological span and lithic variability that do not have close affinities with other approximately contemporary aggregates in North-West Africa. For this reason, I have suggested the use of the general term of Lower LSA for the other techno-complexes in the region succeeding the Aterian and preceding the Iberomaurusian or Upper LSA (Garcea 2006b).

The Jebel Gharbi (Tripolitania, western Libya) is the only other place where Lower LSA artefacts were found in North-West Africa (Figure 4.2). It was first recognised in the Wadi Ghan, on the surface on top of terrace deposits containing Aterian artefacts (Hey 1962), which provided evidence for a stratigraphic succession of the Aterian before the LSA. During recent investigations, other similar artefacts were found again in the Wadi Ghan, as well as at other sites (Barich *et al.* 1996, 2003a, 2003b; Garcea 2004a, 2006a, 2006b; Garcea and Giraudi 2006). At Ain Zargha (Ras el Wadi), near a permanent water spring, a stratigraphic series displayed, from the bottom to the top, a horizon with Early MSA artefacts, a horizon with Aterian artefacts, and a paleosol containing LSA artefacts that was included between two discontinuous layers of calcrete. The lower calcrete was dated to 27,310 ± 320 BP by conventional radiocarbon and 30,000 ± 9000 BP by the U/Th method, and the upper calcrete was radiocarbon dated to 18,020 ± 190 BP (21,610 to 20,090 cal. BP) (Garcea 2004a, 2006b; Barich and Giraudi 2005; Giraudi 2005; Garcea and Giraudi 2006).

At Ain Shakshuk, near another permanent water spring at the foot of the mountain range, a test excavation brought to light a number of thin aeolian layers with charcoal, lying on top of an anthropic soil with Aterian artefacts. The lower part of the charcoal-bearing horizon contained an elongated blade that was attributed to the LSA, and gave an AMS radiocarbon date of 30,870 ± 200 years BP. The upper part of the deposit did not contain archaeological artefacts, but still formed at the time of the LSA, as the charcoals were dated to 24,740 ± 140 BP and 25,500 ± 400 BP by the AMS radiocarbon method (Giraudi 2005; Garcea and Giraudi 2006).

The Jebel Akhdar was inhabited throughout the Aterian and the Dabban. McBurney (1967) established the shift from the former to the latter industry on typological grounds, which is corroborated by the radiocarbon dates. On the other hand, in the Jebel Gharbi, the Lower LSA appeared about 30,000 years ago and, therefore, is contemporary with the Late Dabban, being about 10,000 years younger than the inception of the Early Dabban in Cyrenaica. As the Aterian disappeared around 40,000 BP, like everywhere else in the Maghreb, the Jebel Gharbi and its surroundings seem to have remained uninhabited for several millennia.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Jebel Irhoud
MOROCCO
TUNISIA
Tripoli
Jebel Gharbi
Benghazi
Haua Fteah
Hagfet ed Dabba
Jebel Akhdar
Tel Aviv
Amman
Boker Tachtit
Cairo
Fayum
Siwa
Ouargla
Cape Juby
Laayoun
Great Western Erg
Great Eastern Erg
WESTERN SAHARA
ALGERIA
Tassili n' Ajjer
15
Sabha
LIBYA
Farafra
Sodmein
Nazlet Khater
Red Sea
EGYPT
Aswan
Uan Afuda
Uan Tabu
Tadrart Acacus
Hoggar
20° N
Nouadhibou
Taoudenni
J. Awaynat
MAURITANIA
MALI
Djado
Tibesti
Nouakehott
Tilemsi
Arlit
Adrar Bous
Ténéré
Aïr
Bilma
Atbara
Khartoum
Ennedi
Blue Nile
Tombouctou
Gao
CHAD
White Nile
NIGER
Nyamey
Bamako
Niger
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Figure 4.4 Estimated extent of the Lower Later Stone Age with sites cited in the text.

Evolutions in the Lower Later Stone Age

The typological differences between the Dabban and the Aterian techno-complexes induced McBurney (1967) to suggest a cultural replacement by groups skilled in laminar technology. He supposed that they came from the east, as the Dabban seemed to be comparable with the Emiran of the Levant. J. D. Clark (1993) supported a Near Eastern origin and found affinities with the Ahmarian, noting that the Dabban was broadly contemporaneous with the Ahmarian blade industries, which evolved from the local southern Levantine Mousterian with Levallois point technology. Marks (1975) also compared Cyrenaica to the Levant, as in both areas the blade technology followed the Middle Palaeolithic within a short time, but he remarked specific technological differences between the two regions, namely a prevalence of backed blades (Figure 4.5, 1–5) and opposed platform cores with alternately struck blades in Cyrenaica, and rare backed tools and opposed platform cores in the Levant. Furthermore, he observed that Dabban endscrapers (Figure 4.5, 6–9) are not comparable to the finely made pieces of the Levantine Aurignacian, and that burins (Figure 4.5, 10–11) and especially chamfered blades (Figure 4.5, 12–13) are the only significant typological affinity between the Early Dabban and the Levantine Upper Palaeolithic. However, he also noted that they only occur in coastal Lebanon, but not in Israel, which would be a closer natural link with North Africa. Marks and Volkman (1987) supported technological continuity between the Middle and the Upper Palaeolithic in the Levant, as shown by the production of Upper Palaeolithic types with Middle Palaeolithic techniques at Boker Tachtit, in the Negev (Israel). In my opinion, if the Ahmarian blade production reasonably evolved from the Levallois Mousterian, the Dabban blade industry may as well have evolved from local North African traditions, such as the Aterian. This does not rule out that Cyrenaica was placed in a privileged geographic position and that it received some external influences. Nevertheless, both chronological and technological evidence show that some local traditions did not disappear from Cyrenaica between the last Aterian and the early Dabban occupations. They were part of the earlier acquisitions of the advancing modern behaviour.

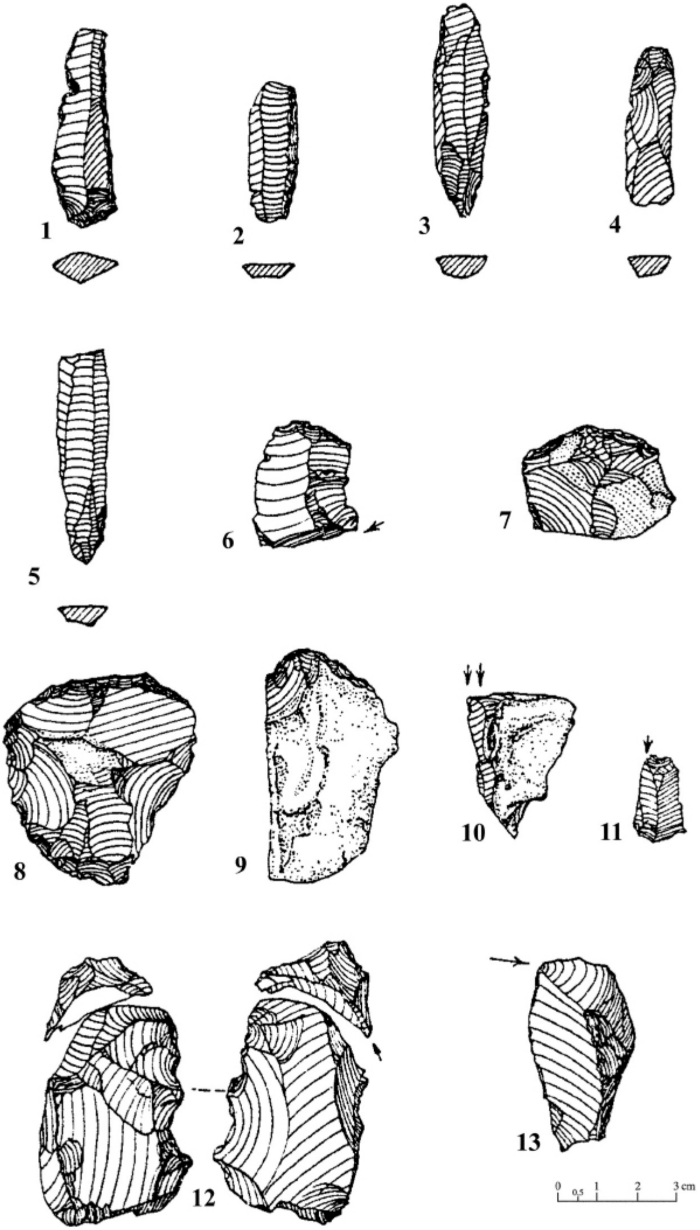

Figure 4.5 Dabban tools: 1–5. Backed blades; 6–9. Endscrapers; 10–11. Angle burins; 12. Chamfered core-tool with fitting spall; 13. Chamfered blade (Haua Fteah) (adapted from McBurney 1967).

Some techno-typological affinities between Cyrenaica and the Levant seem to be too generic to represent distinctive cultural markers, as may be the case of chamfered blades and Emireh points. Their occurrence in different regions does not contradict local developments. This also applies to other similarities, such as laminar production and some bifacial foliates, which have been suggested for the Dabban and the site of Nazlet Khater 4, in the Nile Valley. On the other hand, Nazlet Khater 4 has not been considered comparable with Boker Tachtit (Vermeersch *et al.* 1990b), whereas the transitional Middle-Upper Palaeolithic industry from Sodmein Cave, on the Red Sea mountains of Egypt, includes Emireh points (Van Peer *et al.* 1996). Therefore, these general traits may be evocative of some influences, but are too sporadic and insufficiently meaningful to imply strict cultural connections (cf. also the discussion by Marks 1968).

The maintenance of the same settlement system provides a further indication of continuity. As regards the Dabban, it is normally found on top of MSA settlements, suggesting direct evolution from one occupation to the other. Moreover, the Lower LSA human groups of the Jebel Gharbi adopted the settlement system put in place by their Aterian predecessors. Lower LSA occupations occur at the same water springs that were first exploited by the Aterians.

Even though many technological innovations occurred with the Dabban/Lower LSA, some technological strategies were not newly created and had been already conceived in Aterian times. Among them, hafting was first devised when Aterian tanged tools started to be produced. Concerning the Dabban, hafting was suggested for heavy-duty tools such as adzes. A further development of hafting was the technique of mounting the small Dabban backed blades on composite tools.

To sum up, there are multiple lines of evidence suggesting that the Dabban may have evolved from the Aterian. They relate to both some aspects of techno-typological productions and the continuity in the respective settlement systems.

Revolutions in the Lower Later Stone Age

The most drastic change from the past is the lack of archaeological sites in the Maghreb dated between about 40–30,000 and 20,000 years ago, when the Lower Later Stone Age appeared in northern Libya. In fact, apart from Libya, no LSA sites, dating between the latest Aterian at 40,000 BP and the earliest Iberomaurusian (Upper LSA) at 20–22,000 BP, can be found in the western Maghreb (Barton *et al.* 2005).

Even in Libya, in both the Jebel Akhdar and the Jebel Gharbi, there is patchy evidence for Lower LSA occupations. Such a marked decrease of sites signals a dramatic population contraction contrasting with the numerous Aterian sites that were widely spread throughout the Sahara and beyond its northern margins. The occupation of the Sahara by Aterian groups appears to have ended before that in the Maghreb, coming to an end probably around 60,000 years ago. To date, the only place where there does not seem to be a discontinuity in the human occupation is the Jebel Akhdar. The population drop at the MSA/LSA transition seems to be a unique event in the Mediterranean basin. In Europe, a steady population increase until *c.* 31,000 BP has been suggested in relation to the growing number of Aurignacian sites, and another increase is recorded at Gravettian sites between 32,000 and 27,000 BP (Davies and Gollop 2003). The picture in the European Mediterranean is somewhat different, with a slower growth of sites, possibly due, it has been claimed, to the worsening climate (van Andel *et al.* 2003). If climate is the reason, it must have been more severe on the African coast as there are extremely few Lower LSA sites in Northern Africa, including Hagfet ed Dabba and Haua Fteah in the Jebel Akhdar, and Wadi Ghan, Ain Zargha, and Ain Shakshuk in the Jebel Gharbi (Garcea 2006b).

The new technological input is apparent in the Dabban lithic production. McBurney (1967) suggested that the almost microlithic backed blades were made by the soft hammer or punch technique, which had never been previously employed. The invention of microlithism not only exhibits sophisticated technical skills, but also indicates the emergence of a new concept: the idea of composite tools, which will be further developed in later times. The investment in the labour-intensive production of microlithic pieces yielded the advantage of having tools that could be more easily and quickly repaired or resharpened by replacing single pieces that were mounted together on composite tools.

The manufacture of polished stone tools was a further innovation that appeared in the Late Dabban at Haua Fteah. The use of grinding stones and mortars may also be associated with reduced mobility and continual use of the same sites and the same implements. This stone working technique, which is often combined with the Neolithic in several parts of the world, including most of the Mediterranean, appeared around 30,000 years ago along the North African coast.

Challenges of Climatic Conditions

The coastal strip of land with Mediterranean vegetation is presently only a few kilometres wide and has not been much wider in the last 50,000 years. Therefore, North African populations had to develop skills to live under semi-arid and arid conditions. As the ability to adapt to different environments and climatic conditions, including arid ones, has been associated with modern behaviour (cf., *e.g.* Garcea 2004b), it is interesting to observe to which extent the environment could challenge human populations in this part of the Mediterranean basin.

Although Aterian groups developed a rather successful desert-oriented adaptation, their occupation in the Sahara came to an end when aridity increased beyond sustainable conditions (Clark 1993). Even in the Maghreb the climate was semi-arid, but it was still able to sustain some of the populations who had left the Sahara, when conditions became hyper-arid in the south. The Sahara remained uninhabited by humans between about 60,000 and 10,000 years BP, while North-West Africa offered favourable conditions to Aterian populations until the end of their existence, *c.* 40,000 years BP. A thorough research on the palaeoclimate in the Jebel Gharbi during the Late Pleistocene (Giraudi 2005) has shown that aeolian sand beds were deposited in the Libyan peridesert when the Sahara expanded northward during arid spells. The earliest recorded accumulation of aeolian sand occurred during OIS 4, between 70,000 and 58,000 BP, and the next one only deposited around 21–20,000 BP.

During OIS 3, the climate was slightly moderate in the entire Maghreb, with alternating humid and drier spells (Causse *et al.* 2003). At low altitudes, patchy rainfall supported steppe grassland and, at higher altitudes, oak woodland was abundant around the northern borders of the Sahara. However, slightly after 50,000 BP, desert conditions expanded beyond 30° N, reaching the southern fringes of the Libyan mountain ranges (Wilson *et al.* 2000, Figure 8, 16). It has been stated (Lahr and Foley 2003) that temperatures around 44–43,000 BP approached those of the Last Glacial Maximum. As cold temperatures correspond to hyper-aridity in Africa (*e.g.* deMenocal 1995), they probably caused challenging conditions even in the Maghreb and, consequently, led to the end of the Aterian adaptation (Garcea 2006b).

A mild interval succeeded around 39–36,000 BP (van Andel and Tzedakis 1996) which early Dabban groups may have appreciated in the Jebel Akhdar, but not in the Jebel Gharbi and the Gulf of Sirte, where there still were semi-desert conditions. Another mild interval has been dated to 28–25,000 years ago in the Mediterranean basin (Macklin *et al.* 2002), and to 30,000 BP in central-southern Tunisia (Causse *et al.* 2003). It is possible that this more moist phase favoured the expansion of Late Dabban/Lower LSA groups from Cyrenaica to the west, into the Jebel Gharbi (Garcea 2006b).

Given that seriously severe climatic conditions were extremely unusual during OIS 3 in the Maghreb, the climate could only have played a secondary role in either favouring or discouraging human settlements. The uninterrupted human occupation of the Jebel Akhdar provides archaeological support to the palaeoclimatic evidence. The faunal remains from the Dabban layers at Haua Fteah, as well, indicate favourable climatic conditions and a subsistence economy based on hunting of megafauna, mostly caprines (Barbary sheep and gazelle) and smaller quantities of large bovines, hartebeest, and wild horse, and no exploitation of small animals or aquatic resources (Higgs 1967). Barbary sheep was the only represented taxa in the Aterian and increased again in the Late Dabban probably due to an arid spell (Klein and Scott 1986). Thus, environmental conditions alone did not exert any constraining pressure on humans by providing absolutely unbearable habitats, as they did in the Sahara. Nevertheless, they did challenge human populations and Lower LSA groups adjusted better sustaining certain critical periods than Aterian populations.

The primary move in the shift from the Late MSA to the Lower LSA came from human behaviour which had a vital function in abandoning or continuing certain cultural traditions. The Aterian tradition came to an end when climatic conditions required further adaptive skills in addition to those already developed (tool variability, wider range of exploited raw materials, articulated settlement organisation, new settlement system). On the other hand, where people were equipped with the successful skills, some of them possibly coming from external sources, they adopted and applied the necessary changes (new core reduction methods, new stone manufacturing techniques) and, later, even managed to expand along the Mediterranean littoral.

Seafaring or Sea Fearing?

The distance between the Maghreb and the Iberian Peninsula is, and has always been, very narrow. The Strait of Gibraltar is presently just 14 km wide and was narrower during several phases of the Upper Pleistocene. Consequently, population movements and cultural diffusions between North Africa and Southern Iberia have often been proposed (see, among others, Debénath *et al.* 1986; Smith *et al.* 1995; Otte 1997; Barton *et al.* 2001). The Solutrean in particular seemed to be the most apparent evidence for direct influence from the Aterian, given supposed affinities between Solutrean foliate points and Aterian points and an assumed contemporaneity of the two industries (see, among others, Caton-Thompson 1946; Smith 1966). This analogy has been contradicted on technological, physical anthropological, and chronological grounds (e.g., de Sonneville-Bordes 1966; Hublin 1993; Souville 1998; Kleindienst 2000; Straus 2001), but the diffusionist idea is still regarded with some respect (*e.g.* Finlayson 2004). This is especially due to the persevering confusion regarding the age of the Aterian, which is still occasionally considered to be contemporary with the Solutrean, and to have influenced it around 21–19,000 years BP (*e.g.* Bouzouggar *et al.* 2002).

The evidence from Libya, both from the Libyan Sahara (Tadrart Acacus mountain range) and the eastern Maghreb (Jebel Gharbi), has provided sound and updated evidence, obtained from technological, anthropological, organisational, and environmental data, which supports technological and behavioural convergence, without mobility or diffusion, between Northern Africa and South-Western Europe (Garcea 2004a). The paucity of Aurignacian sites in Spain, which are less numerous than in other parts of Europe, has been referred to the worsening climatic conditions and to their distance from the Danube trail across Europe. Nevertheless, as they were not completely lacking, their origin has been dubiously located across the Strait of Gibraltar (van Andel *et al.* 2003). However, a large set of archaeological data demonstrates that the Aterian cannot be compared with either the Solutrean, which is much younger, or the Aurignacian, which exhibits a totally different lithic technology, including Dufour bladelets and lacking macro-flakes and Levallois products, as in the Aterian. Geographic differences are also evident. The Aurignacian sites contemporary with the latest Aterian sites in the Maghreb are located north of the Ebro valley, which is in northern Spain, farther from the Strait of Gibraltar (for a thorough discussion, see Garcea 2004a). Furthermore, phylogenetic studies on present population samples from North-West Africa and the Iberian Peninsula, based on genetic markers of both Y-chromosomes and mitochondrial DNA, show a clear separation between the two populations since the Late Pleistocene (Bosch *et al.* 2001, 2003). They demonstrate that the genetic distance between populations from Iberia and the Middle East is less than that between populations from Iberia and the Maghreb. Bosch *et al.* (2003) maintain that the Palaeolithic substrate preserved in the Maghreb is distinct from the European Palaeolithic substrate. In particular, results on biallelic polymorphisms in the human Y-chromosome indicate that the Late Pleistocene populations of North-West Africa and Iberia originated from distinctly different patrilineages and that the Strait of Gibraltar functioned as a separating barrier to gene flow (Bosch *et al.* 2001). Moreover, they point out that North-Western African populations probably derived from Eastern African groups, as also noted on archaeological grounds (Ambrose 1998a; Bar-Yosef 1998; Garcea 2006b).

The tectonics and shoreline history of Gibraltar provide an additional body of information that should be considered before regarding the Strait of Gibraltar as a bridge between Africa and Europe. The coast at the Pillars of Hercules formed through several events of collision tectonics, which produced highly elevated marine terraces since about 250,000 BP. Therefore, the supposed Aterian or LSA sailors would have landed on rather unwelcoming semi-vertical cliffs that were several metres high. Moreover, the coastal plain was covered with climbing dunes of the Catalan Sands that developed between 50,000 and 40,000 BP (Rodríguez-Vidal *et al.* 2004).

To sum up, results of genetic and geo morphological research come to the same conclusion as the archaeological and physical anthropological data, which demonstrate that neither Aterian people, nor the meagre LSA groups, were involved in seafaring and were probably more fearful than attracted to the sea.

The MSA and LSA Mosaics in North-West Africa

The Aterian displays general common techniques and tool-kits over the wide Saharan and Maghrebi regions and covers tens of millennia, spanning between at least 80,000 years BP and 40,000 BP. As it is so widely spread and so long-enduring, it could not have been an undifferentiated and homogeneous cultural complex. Separate Aterian groups lived in various North African areas, giving rise to distinct cultural traditions and forms of adaptation throughout their long existence in diversified environments (cf. Garcea 1998c, 2006a). Attempts to assess functional, regional, or chronological variations have been made. Some have been more propositional (*e.g.* Clark 1982; Tillet 1983) than others (*e.g.* Wengler 1997). I have suggested that Aterian peoples adopted isolated forms of social organisation, which can explain the conservative duration of some technical traditions and the presence of various Aterian identities (Garcea 2004b). The Maghrebi Aterian seems to have lasted longer than the Saharan Aterian; the latter can be subdivided into, at least, a Central Saharan variant and a Southern Saharan variant. Moreover, the Aterian, particularly its Southern Saharan facies, has been compared with the Lupemban of Eastern and Central Africa as both industrial complexes share some close affinities, including bifacial lanceolates and core-axes (cf. Clark 1982; Kleindienst 1998; Garcea 2004a; Gifford-Gonzalez *et al.* in prep.). Unfortunately, not many Aterian sites have been dated and, therefore, it is impossible to define the precise lapse of time for each of the Aterian variants. Nevertheless, the available data show that chronology is an acceptable variable for distinguishing differences between dated sites, such as those in the Maghreb and those in the Sahara, the former being occupied for a longer period than the latter. Regional variation is another plausible factor, considering the environmental differences of a territory extending from the Mediterranean Sea to the Sahel and from the Atlantic Ocean to the Egyptian oases, including lowlands, plateaus, and high mountain ranges.

In spite of the evident skills to adapt to a variety of ecological and environmental conditions, the Aterian expansion abruptly stopped at the African Mediterranean shores and did not extend into either Europe or Asia (Figure 4.1). If there are numerous reasons to motivate the lack of relations between Aterians and Mousterians or Aurignacians in Europe, namely Iberia (cf. Garcea 2004a), there seem to be less explanations for the lack of contacts beyond the Sinai. Still, based on current evidence, it is clear that Aterian groups did not enter the Levant (cf. Marks 1992).

In addition to the Mediterranean Sea, the river Nile may have been another major border for the Aterian expansion towards the Levant. The Nile Valley must not have been attractive to desert-oriented Aterian populations, as they did not settle along the river, and may have been only occasionally in contact with the groups that used the valley for extracting raw materials. In fact, numerous sites in Upper and Middle Egypt, particularly those belonging to the so-called Nubian Complex, are quarries and workshops (Vermeersch *et al.* 1990a; Van Peer 1991; Kleindienst 2000; Vermeersch 2002). Furthermore, if the Nile was a natural barrier, more so must have been its Delta, which blocked the Aterian expansion toward the Levantine coast.

The end of the Aterian is approximately contemporary with the climatic deterioration that took place around 44–43,000 years BP, when temperatures approached those of the Last Glacial Maximum (Lahr and Foley 2003). Hyper-arid conditions in the Central Sahara had already forced humans to abandon the area some 10,000 years before. On the other hand, the plant and animal landscapes, at least in some parts of the Maghreb, remained somewhat suitable for human life. Climatic factors were not the determining reason for the end of the Aterian, although they influenced the adaptation pattern of Aterian groups. In reality, an Aterian crisis began much earlier than at the time of its end. It can be traced back to OIS 4, when the severely dry conditions in the Sahara caused population dispersal and probably a conspicuous demographic contraction, as well. Thus, during the period between 50,000 and 40,000 BP, Aterian groups must have been very small and even more isolated than before, surviving in the Maghreb and possibly in the southern Saharo-Sahelian fringes.

The Aterian crisis provides some interesting clues on the MSA/LSA transition in North-West Africa. Population pressure, triggered by the new arrival of anatomically modern humans, is often considered as one of the causes leading to the cultural changes of the Upper Palaeolithic in other parts of the world. However, the North African population producing the Aterian industrial complex already consisted of morphologically modern types. Furthermore, as the last Aterians were numerically very few, it is unlikely that they suffered any significant demographic pressure. In spite of their scattering in search of diminishing food resources, their continuous decline proves that they did not have the means to compensate for food shortages and were not sufficiently skilled to cope with the ongoing crisis which had started during OIS 4, from which they did not recover even under the milder conditions of OIS 3.

The dramatic population reduction becomes more evident during the period between 40,000 and 20,000 years ago, corresponding to the Dabban or the Lower LSA. At this time, even most of the Maghreb appears to be devoid of human life. The only archaeological sites dating to this period are located east of the Maghreb (Jebel Gharbi, Tripolitania and Jebel Akhdar, Cyrenaica).

Climatic conditions were not favourable to Lower LSA populations. The desert expanded beyond 30° N, reaching the southern fringes of the Libyan mountain ranges. Nevertheless, other more stringent arguments should be advocated for the paucity of Lower LSA sites in North-West Africa. For example, it is possible that the last Aterian groups seriously degraded and depleted most of the areas where they were living.

The question regarding replacement by new groups or continuity is another widely discussed issue of the Dabban. Putative new groups were thought to have come from the Near East, given the similarities with some of the Emiran and Ahmarian tools. However, climatic conditions in South-West Asia were as arid as in North Africa and Upper Palaeolithic populations in the Near East had to shift from an intensive to an extensive exploitation of resources due to their deteriorated environment (Marks and Volkman 1983). Because of the changed climate, they could only occupy the arid belt in the wetter seasons (Bar-Yosef 2000b). Therefore, it is likely that they had a rather short-range mobility system and were not much encouraged to venture into lands that were as dry as their own. This does not rule out that contacts, communication, or trade between the two regions, especially between the Levant and Cyrenaica, occasionally existed without migration. Furthermore, considering the small number of Lower LSA sites (Figure 4.4), if replacement did take place, it must have involved very few people, probably too few to allow one to actually speak of 'replacement.' Moreover, if new groups settled in a practically empty land, they would have been likely to choose other areas, with similar resource availability, than those already occupied. By contrast, the Lower LSA settlement system is in direct continuity with the previous Aterian settlement organisation, as shown in the Jebel Gharbi and Jebel Akhdar, where the Lower LSA sites occupy the same areas previously chosen by Aterian groups. Therefore, it seems more plausible that the Lower LSA evolved from the previous Aterian, as also the chronological continuity in the Jebel Akhdar would suggest.

To sum up, both environmental and behavioural evidence concur to argue for autochthonous and independent developments in both the Levant and the eastern Maghreb. The techno-typological similarities may result from either convergence or a widely shared style of production of common tools, such as chamfered blades and Emireh points. In fact, these tools seem to be too generic to represent distinctive cultural markers. Emireh points occur not only in the Near East and the eastern Maghreb, but also in Egypt (Van Peer *et al.* 1996; Henry 2003).

It has been proposed (*e.g.* Harpending *et al.* 1993) that, with the onset of the Upper Palaeolithic, a more effective technology, giving access to a broader, more reliable food supply, would have led to an increase in population size. However, this does not apply to Africa. Recent archaeological evidence from North-West Africa corroborates Ambrose's (1998b) remarks that no population growth accompanied the transition to modern technology in either Northern or Southern Africa. As noted before, the MSA/LSA transition in North-West Africa appeared more like an evolutionary adjustment than a revolutionary break as it was performed by pre-existing fully modern humans. Such an anatomical continuity did not witness the same new wave of hyper-efficiency and hyper-effectiveness that other Mediterranean populations experienced. Rather, it implies an asynchronic gap between anatomically modern human populations and some of the modern behaviours that would have produced more efficient techniques and more effective tools (cf. Ambrose 1998b). Such a conservativism turned out to be disadvantageous for the modern humans who kept basically non-modern MSA industrial complexes.

Although the available data on the Upper Pleistocene populations of North Africa, and particularly the fossil record, are still rather incomplete, both Aterian and Lower LSA groups in most of Northern Africa appear to have been quite isolated and, thus, excluded from major biological and cultural events involving the dispersal of both anatomically modern humans and the Upper Palaeolithic/LSA technology out of Africa into Eurasia. While Aterian people did not leave the

African continent and Neandertals did not enter it, some North-West African Lower LSA groups and others from the Negev and the Levant may have moved along the Mediterranean coast coming into contact with each other.

Contrary to what has been stated, the Mediterranean Sea has often represented a barrier to the expansion of Upper Pleistocene North African populations. However, North Africans always largely benefited from the maritime climatic and environmental conditions, which they shared with all the people facing the same sea.

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5. Egypt from 50 to 25 ka BP: a scarcely inhabited region?

Pierre M. Vermeersch

ABSTRACT

Because different parts of Egypt have undergone different research intensities and taphonomic histories and because environmental fluctuations influenced differently each region, we describe the prehistoric record for each part of the country separately, emphasizing the regional cultural situation. In the Sinai, during a wet phase, between c. 34 and 28 ka BP, numerous sites are related to the southern Levantine Ahmarian. In Lower and Middle Egypt, due to the low Mediterranean sea level, remains of eventual human presence are most probably eroded or covered with thick deposits. No sites have been studied in detail. In Upper Egypt there are clear indications of a transition from Middle Palaeolithic style assemblages to Upper Palaeolithic ones (Taramsa 1). They are older than 45 ka BP. Such transitional assemblages have their roots in the local Middle Palaeolithic of the Lower Nile Valley Complex. No connections have as yet been found with what happened in the Mediterranean Levant. From 35 ka onwards, another type of blade technology (NK-4) is known by only a few sites. Egypt, in this period, seems to be looking more to the South than to the Mediterranean. Around 25–22 ka, the Shuwikhatian is a blade industry with typical Upper Palaeolithic tools, which forms probably the final stage in an evolution out of the local Middle Palaeolithic. Within the framework of North Africa and southwest Asia, the Upper Palaeolithic of Upper Egypt seems to be rather insular. The occupation of the Western and Eastern Desert was probably very rare or even non-existent. During the entire period from 50 to 25 ka BP population density in Egypt was apparently very low and probably restricted to the Sinai and the Upper Egyptian Nile valley.

Introduction

The period under review encompasses the transitional technological phase between the Middle Palaeolithic and the Upper Palaeolithic.

It is now generally understood that in Northeast Africa, the interglacial periods, OIS Stages 5e, 5c and 5a, are wetter than they are presently because the monsoon precipitations extended from the South to the North (Wendorf *et al.* 1993). The same phenomenon is observed during the early Holocene (Kuper and Kröpelin 2006). During OIS 4–2, the climate was extremely dry. During OIS 3 some wetter spells may have occurred but until now very few data have been found to substantiate the climatic conditions of this long period of interest for this contribution. Moreover, dating of most of the climatic events remains very unsatisfactory. In the North-eastern part of Egypt, near the border with Israel and

Palestine, the climatic conditions are much more varied due to the influence of the Mediterranean climatic conditions, characterised by a strong ecological gradient, which prevails in the eastern Mediterranean (Goldberg 1994).

In this contribution we will review the Egyptian data in a geographic order because it is evident that the different regions in Egypt have been subjected to different environmental conditions, which certainly could have affected the human occupation of the region. We will consider the following regions:

- Sinai
- Lower and Middle Egypt
- Upper Egypt
- The western desert with the oases
- The eastern desert with the Red Sea Mountains

Our review is seriously hampered by the lack of intensified surveys of certain regions and by the postdepositional processes that eventually could result in the obscuring or destruction of sites. One should be aware that, especially in the Nile Valley, very little field work has covered the period under consideration. Moreover, outcropping of deposits of that period is very restricted in surface or are unknown. All field work was done in the lower desert bordering the floodplain. The lower desert is presently entirely destroyed by expanding the irrigated land and by building projects.

In the western and eastern desert the preservation possibilities of sites of the period under consideration is very low, as even Holocene sites are often quite intensively deflated.

Sinai

A wet phase occurred in the Sinai during the period between c. 34 and 28 ka BP (Goldberg 1977). This can be generally correlated with a similar wet phase in the higher Negev. Few sites have been attributed to the earliest period under review. During the excavations of site Sinai-20 (Kobusiewicz 1999) in the east-central Sinai (Figure 5.1:1), a thick cultural deposit was reported as two horizons of displaced artefacts dating to the Mousterian culture with African, rather than Levantine, affiliations. According to Eddy *et al.* (1999, 283) a conservative age estimate of the Mousterian components between 60 and 35 ka is given, based entirely on typological grounds. Furthermore, Kobusiewicz (1999) proposes that the presence of blade elements in the upper component is an indication that this deposit is, as in other Eastern Mediterranean assemblages, very late in the Middle Palaeolithic sequence and may be very early Upper Palaeolithic. This is not necessarily the case as in e.g. in the Amudian from the Levant, blades occur from long before OIS Stage 5 (Bar-Yosef 1998). Moreover, some TL dates suggest that the archaeological occupations of the Lower Horizons of site Sinai-20 took place in OIS Stage 5c, while those from the Upper Horizons during OIS Stage 5a (Kobusiewicz *et al.*. 2001).

Just north of the Sinai, an important sequence has been found in the Negev. At the site of Boker Tachtit (Figure 5.1:2), in the Negev, it is possible to follow a gradual transition from essentially Levallois-oriented core-reduction, dated to about 47 ka BP, to a dominant single-platform blade technology, dated to about 42 ka BP, in which the Levallois method had disappeared (Marks 1983b). In the lower levels (1–3) there are three tool classes, which account for the majority of tools: Levallois points of one sort or another (24 %), burins (22 %) and denticulates and notches (20 %). Tools with blade proportions account for 42 % of all tools. Blades in the strict sense, however, were used for only 36 % of the tools. This tool assemblage is markedly Upper Palaeolithic in appearance (Marks 1983b, 89). Higher up, (level 4) points are the most common tool, accounting for 37 %, followed by scrapers (22 %) and then by notches or denticulates (15 %). Tools with blade proportions are dominant (69 %). On the whole, the retouched tools are characteristically Upper Palaeolithic (Figure 5.2). Carinated tools of the so-called, but much later, "Levantine" Aurignacian, like those of Ksar Akil levels 8–13 (Azoury 1986) and bladelet points of the Ahmarian tradition are absent. It has even been suggested that the whole Boker Tachtit sequence is in fact Upper Palaeolithic (Bar-Yosef *et al.* 1996), but that is only a less relevant question of terminology.

It is not surprising that the wet period is represented by numerous Lagaman sites at Gebel Maghara (Figure 5.1:3) and also probably at Wadi Sudr (Figure 5.1:20) (Baruch and Bar-Yosef 1986). The Lagaman occurs in the basal sand/scree accumulation at the foot of Gebel Lagama (Bar-Yosef and Philips 1977). The assemblages reflect a developed blade technology. The desirability of blades and their efficient production is clearly evident in the extremely high selection of blade blanks in tool production. Similar sites have been found in the Qadesh Barnea Area (Figure 5.1:4), NE Sinai (Gilead and Bar-Yosef 1993). These Early Upper Palaeolithic assemblages (Figure 5.3) are characterised by an overwhelming dominance of blades among both the tools and the debitage and there is a pronounced bladelet component in several assemblages. Both direct and indirect soft hammer were used for blade production. Cores have one or two flat striking platforms. Lipped platforms and curved profiles seem to predominate. Semi-abrupt to fine retouch dominates. There are high frequencies of retouched blades, bladelets and El-Wad points. Burins are the third most numerous tools, while notched pieces form a significant percentage of the assemblage. Endscrapers and denticulates are rare and atypical. Bones were occasionally used as the raw material for making tools, mostly awls. On the whole, the retouched tools are characteristically Upper Palaeolithic. The Lagaman may be seen as the earliest classic Upper Palaeolithic known from northern Sinai. The Lagaman is a local or temporal group within the Ahmarian tradition from the Negev. With dates from 34 to 30 ka BP, it is a little bit younger than the Ahmarian from Boker A (Marks 1983a), which can be dated to about 38,000 BP, and may be seen as the earliest classic Upper Palaeolithic known in the Negev and the earliest representative of the Ahmarian tradition. The absence of carinated tools of the "Levantine" Aurignacian is worth noting. The sites of the Lagama area differ from those from Qadesh Barnea in featuring a relatively high frequency of small cores and more El-Wad points (Gilead and Bar Yosef 1993). The variability between the lithic assemblages (blades versus bladelets) reflects the differences in raw material availability regarding the presence versus absence of large flint nodules.

Some surface-scatters with Ahmarian artefacts are reported from Gebel Igma (Figure 5.1:6) in southern Sinai (Philips 1987; Philips and Gladfelter 1989). Wadi Feiran (Figure 5.1:5) has been surveyed extensively, but Ahmarian sites are found only at the oasis of Tarfa el Quidrein (Philips 1988). Unsystematic fieldwalking surveys of many wadi systems on the eastern and western margins of the Sinai Peninsula have failed to uncover other Upper Palaeolithic sites (Gladfelter 1997). Four Ahmarian sites have been excavated in Wadi Abu Noshra I (Phillips and Gladfelter 1989), which are dated to 30 ka BP. The tool assemblage consists of partially backed blades, blade with ogival base, finely retouched blades and bladelets, endscrapers on blade, truncated blades and bladelets, points made by two oblique truncations, dihedral burins, burins on truncation and one endscraper-burin.

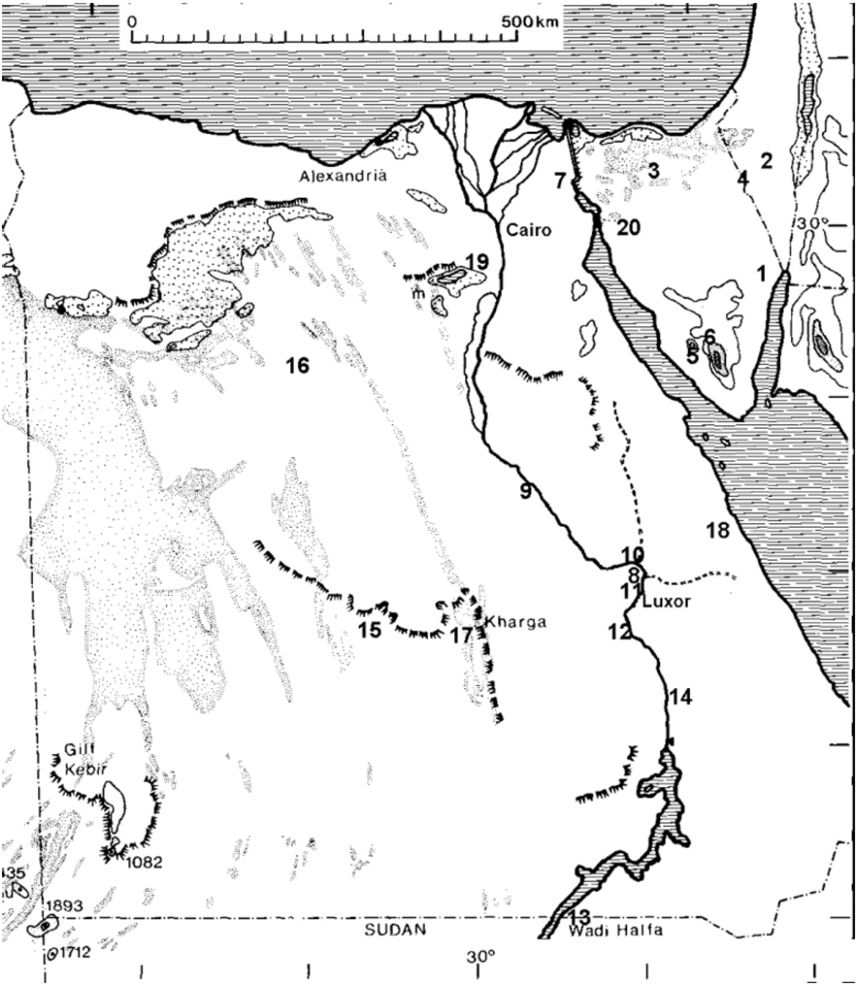
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Figure 5.1. 1. Site Sinai-20, 2. Boker Tachtit, 3. Gebel Maghara, 4. Qadesh Barnea, 5. Wadi Feiran, Wadi Abu Roshra, 6. Gebel Igma, 7. Abu-Suwair, 8. Taramsa, 9. Nazlet Khater, 10. Shuwikhat, 11. El Abadiya, 12. E71K9, 13. Wadi Halfa, 14. Kom Ombo, 15. Dakhleh Oasis, 16. Baharia Oasis, 17. Kharga, 18. Sodmein Cave, 19. Fayum, 20. Wadi Sudr

In this context, we should not forget the prominent position of the Haua Fteah cave site (McBurney 1967; Hahn 1984) in Cyrenaica, Libya, with the longest stratigrapic sequence of north-east Mediterranean Africa, compassing the Middle and Upper Palaeolithic. The last use of Levallois technology at the Haua Fteah is in Level XXV, which is dated to about 42 ka BP. Some time after 40 ka BP, probably in the interval between 38 and 32ka BP, there was a fairly abrupt replacement of the Mousterian industrial tradition by the Dabban. For this reason, no transitional assemblages are present. According to Hahn (1984, 105), tool inventories published by McBurney for the Haua Fteah may have been biased by the fact that more than 10 % of the tools had not been recognised. The presence of crests in the Dabban is suggestive of an Upper Palaeolithic debitage technique. The blade technology is typical Upper Palaeolithic but the bipolar technique and the thick bulbs are reminiscent of the Levallois. A few discoidal cores resembling Mousterian ones are found, but the real Levallois method seems absent. The older Dabban is characterised by 47% backed blades, 16 % endscrapers and 7 % chamfered pieces. In addition to those we find in Layer XXE/XXIA, some bifacial artefacts and Aurignacoid forms, such as nosed-scrapers, are present. Faunal remains (McBurney 1967) associated with the Dabban artefacts consist mainly of *Ammotragus* (77 %), followed by *Bos* (10 %), *Equus* (6 %), *Gazella* (5 %) and *Alcephalus* (2 %).

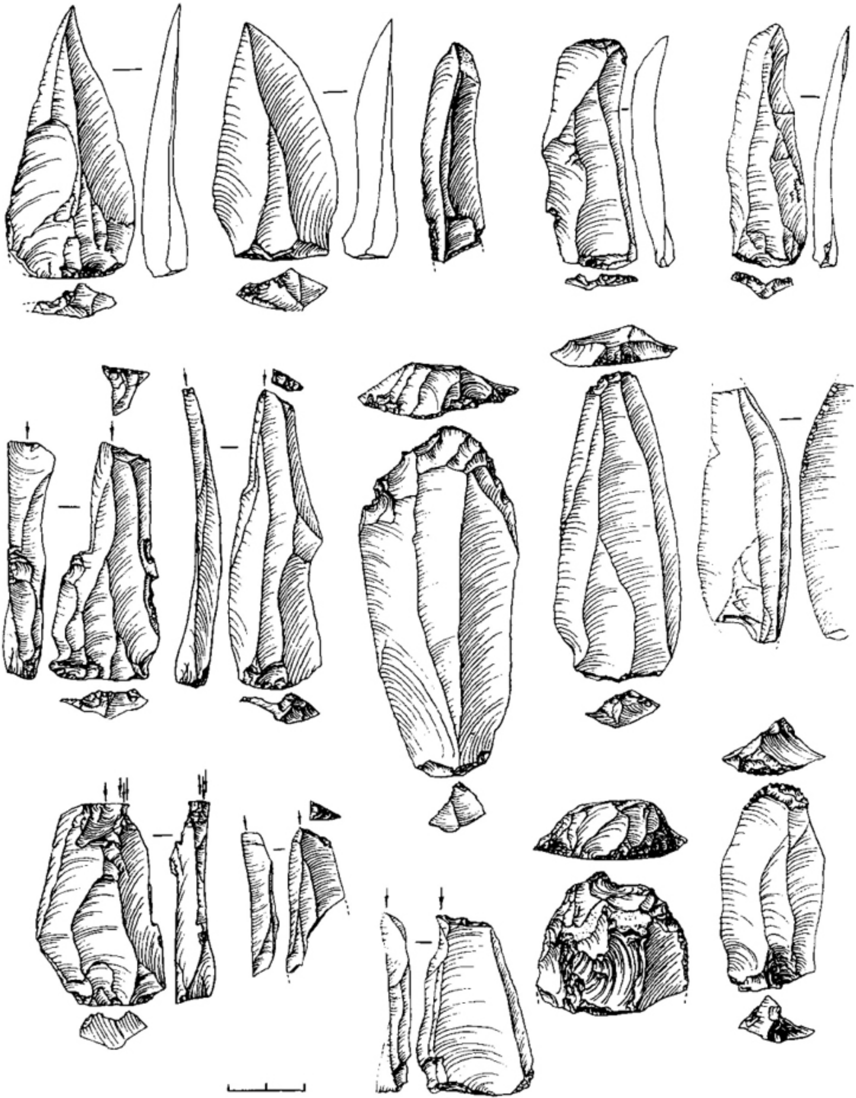

Figure 5.2. Lithic material from Boker Tachtit level 4 (after Marks 1983b)

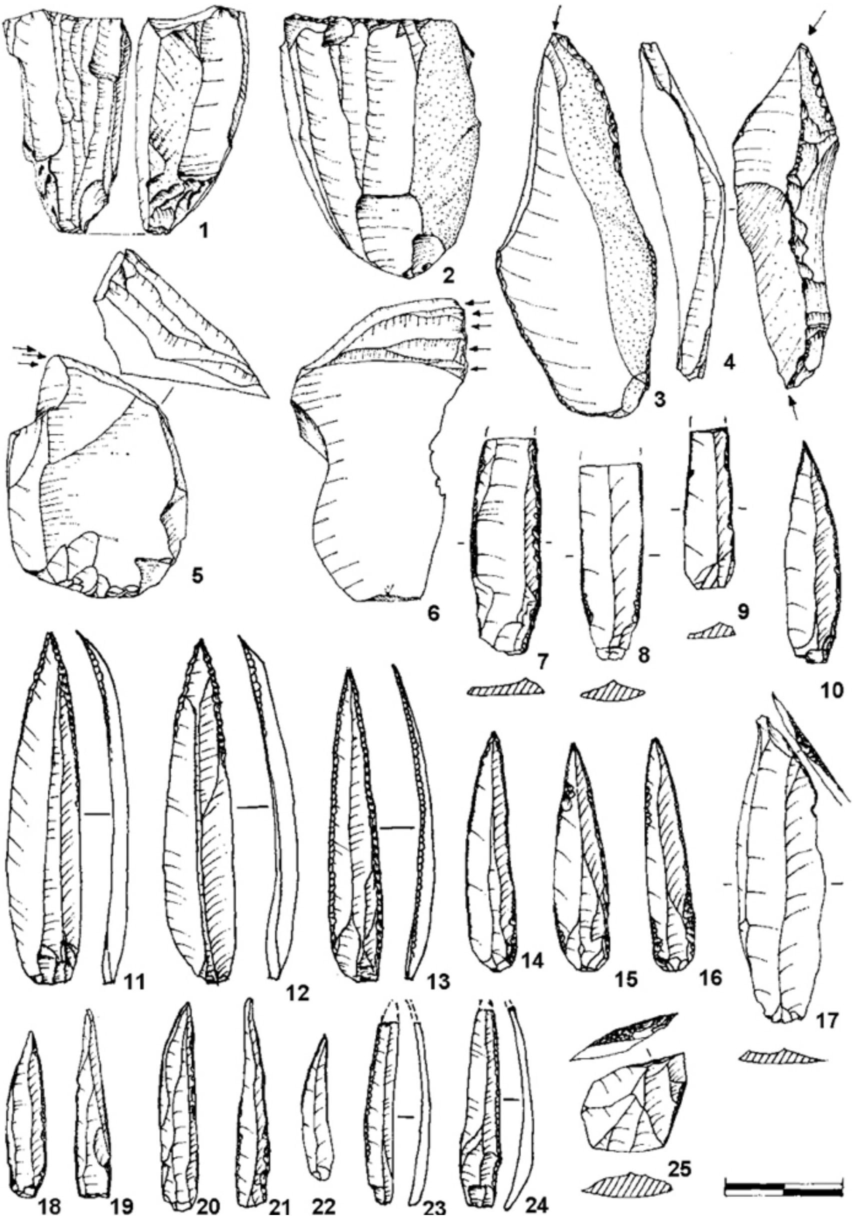
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Figure 5.3. Lithic material from Lagama VII (after Bar –Yosef and Phillips 1977)

There is no doubt that this part of Egypt is strongly related to what happened in the Levantine area. The evolution of its prehistoric occupation can be understood in relation to the Ahmarian.

Lower and Middle Egypt

In Lower and Middle Egypt, due to the low Mediterranean sea level, which is related to the low ocean level during the Last Glacial, the floodplain was built up quite below the present-day floodplain. Therefore, remains of eventual human presence are most probably eroded or covered by thick deposits. This situation results in a total absence of any known human presence in the Lower Nile valley of Egypt, north of Asuyt, as well as very few reliable proxies for the environmental conditions. Therefore, it is nearly impossible to evaluate the possibilities for an occupation during the period under review. Outside the Nile valley, very few sites have been decently recorded and none has been excavated. It has been claimed by Huzayyin (1941), by Caton-Thompson (1946) and by Montet (1957) that some sites in Lower Egypt can be attributed to a diminutive Levallois, which should find its place in the Upper Palaeolithic (Figure 5.4). They refer especially to the Abu-Suwair site (Figure 5.1:7) along Wadi Tumilat in the Eastern Delta. As far as one can evaluate on the basis of some drawings (Montet 1957), it seems that the Halfa flaking method has been used for the production of small thin Levallois flakes. The Halfa method (Marks 1968) is a specialised Levallois technique, with very intense distal, lamellar preparation. It is aimed primarily at the production of secondary Levallois flakes, in other words, flakes presenting a large negative of a first Levallois removal on their dorsal surface. The site of Nazlet Khater 5 (Vermeersch and Van Peer 2002) is also characterised by very small Levallois artefacts. A principal components analysis of Levallois flake attributes (Van Peer 1991) showed that assemblage to be very similar to sectors A and C of site E71P1, near Isna, which Wendorf and Schild (1976) consider as belonging to the Late Palaeolithic. It seems that the Nazlet Khater 5 site is of much more recent age than the other Middle Palaeolithic sites in the area. We presume therefore that the assemblage of Abu Suwair is indeed much younger than the Middle Palaeolithic but we have no arguments for a specific age position.

We would need new field surveys in order to discover sites but, apparently due to the intense human activity in the area, we are afraid that it will be difficult to find undisturbed sites. In the mid-eighties we tried to obtain a survey permit from the Egyptian Antiquity Department for a survey of the area between Cairo and Ismailia. Due to military reasons it was not granted.

Upper Egypt

One of the main problems in this review of the Upper Egyptian situation is the small number of reliable dates. During OIS 5 and early OIS 4, there was a large human population in the Upper Egyptian Nile Valley (Vermeersch 2006). What we know about the population intensity cannot be deduced from the number of occupation sites: they are nearly absent. We only have some knowledge of the human activities outside the then floodplain: chert extraction in the Lower Desert was extremely extensive (Vermeersch and Paulissen 1997). Indeed, an important extraction activity can only be understood in terms of an important population needing raw material. Similar extraction activity seems to be much reduced during the following period, including the 50 to 25 ka period during which we also observe very few traces of human occupation in the Egyptian Nile Valley. It remains difficult, however, to evaluate the reasons for the presence of only a few occupation sites. It is probably partially due to the taphonomic conditions but probably also to a shrinking population. The Nile River became an intermittent river, choked, in Upper Egypt, with thick alluvial and lacustrine deposits and invading dunes (Schild and Wendorf 1989).

Taramsan

In Upper Egypt, we observe the presence of a real blade technology provisionally dated with OSL to 50–45 ka BP (the final dating results of the samples are not yet available from S. Stokes and R. Bailey, Oxford, U.K). It is known only from a single extraction site, Taramsa 1 (Figure 5.1:8). Mining at this site was practised by making trenches and pits for extracting chert cobbles from a local terrace deposit in the lower desert. Here, towards the end of the Middle Palaeolithic, technological experiments with the Leval lois system were conducted (Van Peer 1998). These were designed to produce blades and to enhance core productivity in terms of the number of morphologically controlled products. From a technolog ical viewpoint, these are transitional assemblages (Figure 5.5). The analysis of completely reconstructed flaking sequences by Van Peer (1998) has revealed that the traditional Levallois system had been adapted for the production of blades and that, compared to the traditional Levallois system, its efficiency had dramatically increased. The mechanism involved in the adaptation of the traditional Leval lois concept consists of increasing the exploit able core volume by changing the core organization. The prepara tion of the exploitable volume was initiated at a very wide angle from the lateral core edges to increase the domed character of the upper core. A surface curved to this degree allows the production of a series of very elongated products if core length is sufficient. Most of the intended products show a bi-directional organisation of scars on their dorsal sur faces. With this adapted Levallois system, more than 10 blades can be produced in a single reduction. In some examples, the reshaping of the exploitation face is so limited that the production of blades becomes almost continuous, as in Upper Palaeolithic production systems. As tool typology is restricted because the site is an extraction site, it is impossible to look for typological fits with other assemblages of the area or outside the area. A burial of an anatomically modern *Homo sapiens* child is probably of the same age (Vermeersch *et al.* 1998). We consider the Taramsan to be a technologically transitional phenomenon between the Middle and Upper Palaeolithic.

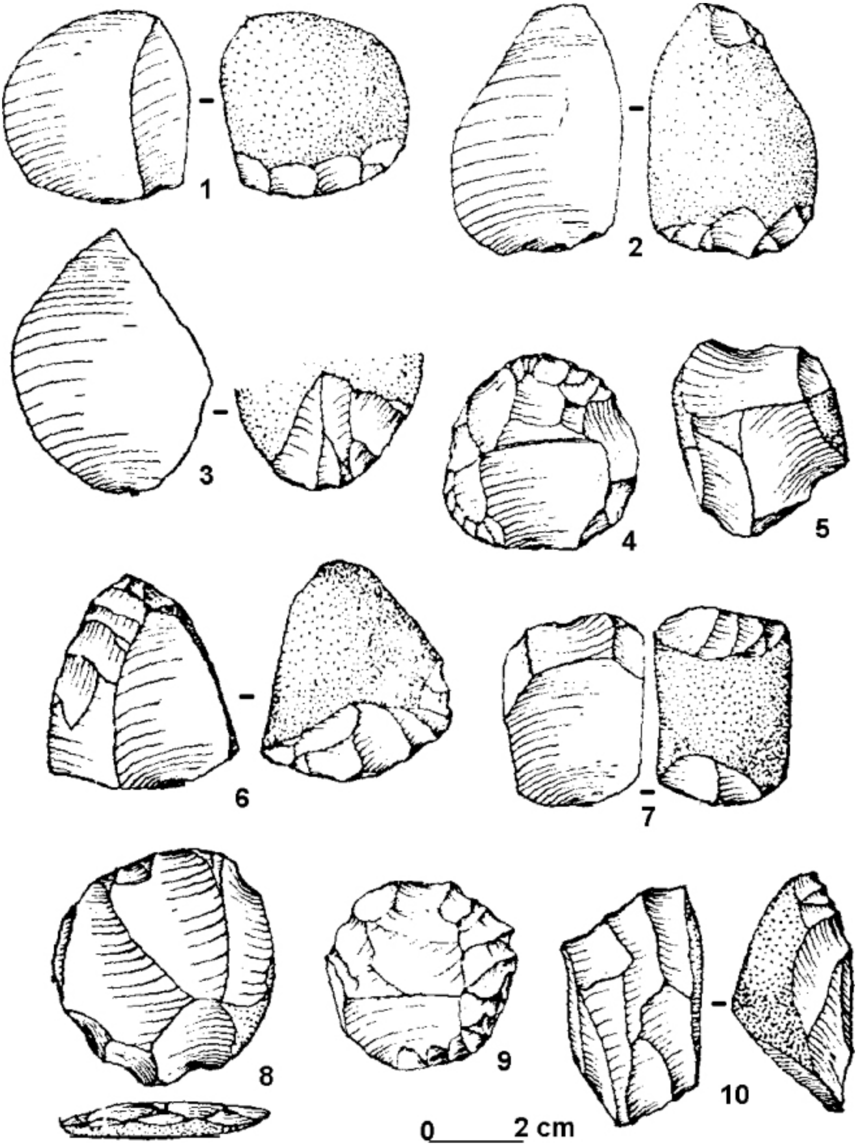
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Figure 5.4. Lithic material from Abu Suwair (after Montet 1957).

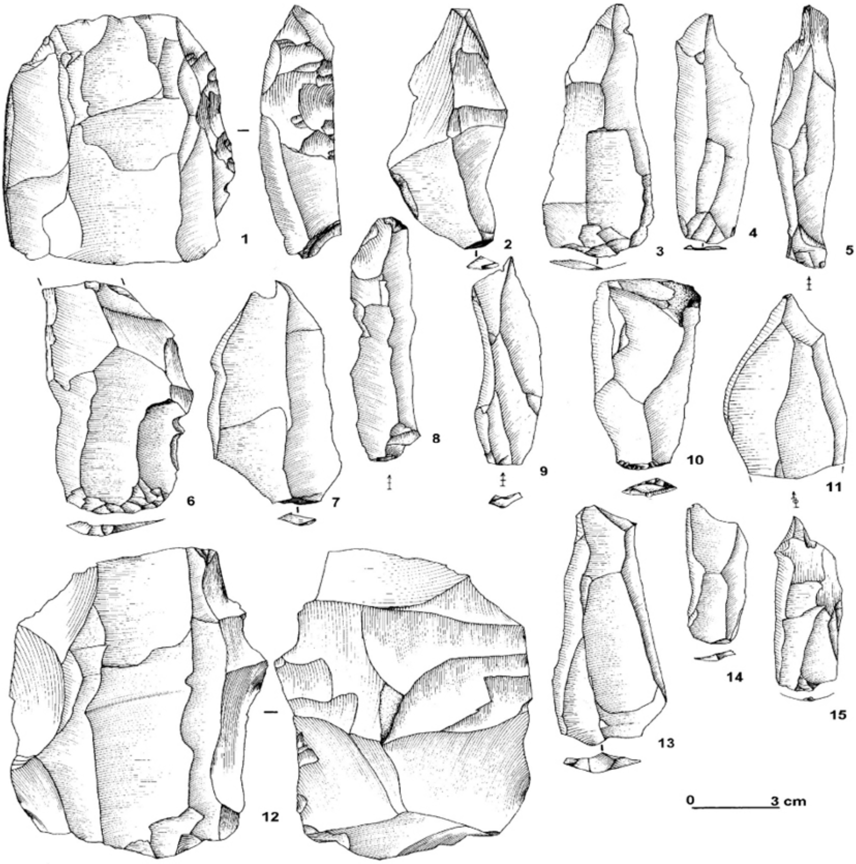

Figure 5.5. Lithic material from Taramsa concentration 1.

Nazlet Khater 4

The oldest Upper Palaeolithic sites are those of Nazlet Khater (Figure 5.1:9), well dated between 35 ka and 30 ka BP (Vermeersch *et al.*. 1982, 1984a, 2002). Only Nazlet Khater 4 has been excavated. It is a chert exploitation site, using underground mining techniques (see below). Similar sites, Nazlet Khater 7 and Nazlet Khater 8, have been found in the immediate surroundings (Vermeersch and Van Peer 2002).

The Nazlet Khater 4 (NK-4) site is situated on a Nile terrace remnant, 10 m above the present floodplain and near a protruding limestone cliff. The base of the site consists of greenish silts and fine sands covered by about 1 m of Nile deposits which are composed of a 30 cm thick layer of well-rounded channel lag gravels with chert cobbles and of a 70 cm thick layer of brown granuliferous consolidated clay. Up to 70 cm of local limestone gravel covers these Nile deposits. The simplest method of prehistoric extraction of the chert gravel consisted of making trenches with a width of ca. 1 m and a depth of ca. 2 m, starting from the wadi slopes. All gravel deposits have been removed from these trenches. A more advanced technique consisted of cutting vertical shafts, dug down to a depth of 2 m for exploiting the channel lag gravel, ending on top of the greenish silts. Sometimes the shafts were enlarged at their base to form bell pits. Finally, underground galleries, for chert extraction from the trench walls or from the bottom of the bell pits, were dug. Proceeding from a central bell pit, the channel lag gravels were exploited for several metres, creating short horizontal galleries, very often with subterranean connections to other shafts. The largest galleries extend for more than 10 m^2. As the thickness of the exploited gravel layer is very restricted, the miners sometimes chopped away the top of the greenish silts over some 30 cm. On the walls of shafts and galleries and in the green silts, cutting marks of picks used in gravel extraction can often be observed. Some of these cutting marks are covered by a calcite crust, confirming their antiquity. The horizontal distribution of the trenches and the bell pits suggests that very large areas of the site had been mined. Gallery roofs have sometimes collapsed. Some picks have been recovered from the horizontal gallery fillings. They consist of gazelle and hartebeest horns, the extremity of which is worn (Figure 5.6). Rough extraction activities were performed with heavy hammerstones of which numerous examples have been found in the galleries. The digging was clearly intended for the subterranean extraction of chert cobbles from the Nile channel lag deposits. The mining resulted in a complete exhaustion of the channel lag cobbles. Their extent, however, was restricted to about 800 m^2.

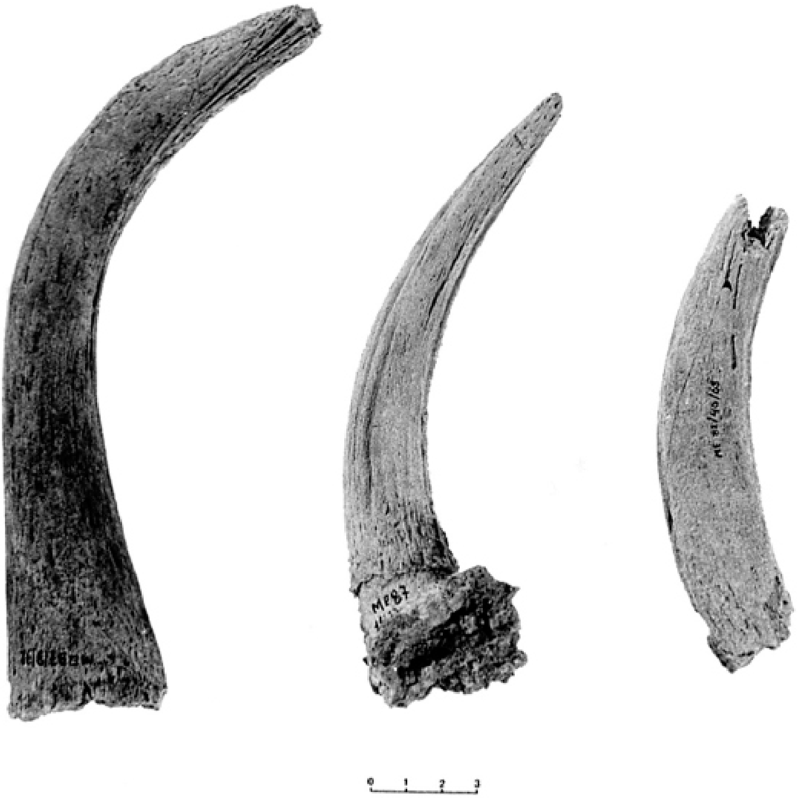

Figure 5.6. Hornpits from Nazlet Khater 4 (Vermeersch et al. *2002a).*

The post-exploitation deposits in the trenches, in the bell pits and in the horizontal galleries, consist of anthropogenic gravel dumps at the base, covered with fine yellow aeolian sand. In situ hearths and charcoal blown into the trenches, the bell pits and the galleries, provided ample ^{14}C-dating opportunities. These dates suggest that the mining activities were spread over a long period, from ca. 30,000–35,000 BP. This age has been confirmed by OSL dating (Stokes and Bailey 2002). A small living floor was encountered in one of the trenches. This Upper Palaeolithic underground mining system with bell pits and subterranean galleries, intentionally shaped to obtain a better exploitation possibility, represents a totally new strategy when compared to the Middle Palaeolithic extraction trenches of Nazlet Safaha (Van Peer *et al.* 2002) and Taramsa 1 (Vermeersch *et al.* 1997). Indeed, Upper Palaeolithic extraction used underground galleries, unknown to the Middle Palaeolithic miners.

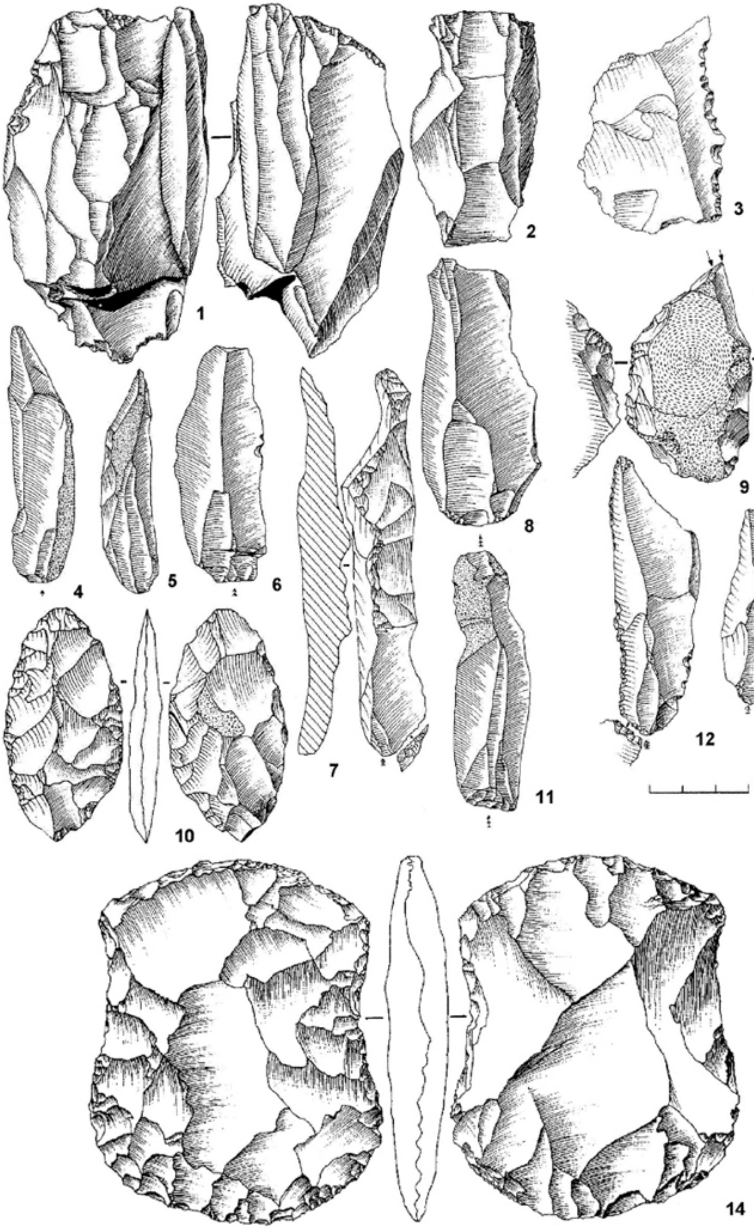

Figure 5.7. Lithic material from Nazlet Khater 4 (after Vermeersch et al. *2002a).*

Debitage techniques are oriented to blade production and are fully Upper Palaeolithic (Figure 5.7). No Levallois or Halfan technology is present. The best-represented core type is the single platform core. Opposed platform cores are also well represented. Normally the reduction strategy was aimed at creating a striking platform by taking away the top of the cobble. As most of the cobbles have a nearly rounded section, blades could then be obtained without preliminary crest preparation. Blades are short, large and rather thick, but sometimes of good quality. Butttypes of flakes and blades are often indicative of a debitage procedure without intensive core preparation. Retouched tools are not numerous and the typological groups are restricted. Denticulates are the best-represented tools, although some burins and endscrapers are present. One carefully bifacially flaked thin foliate has been found. Some bifacial axes have been collected; these are mainly flat, made from flakes or blanks, with concave sides and a convex edge. Hammer stones of about 1 kg are quite numerous. Bone remains are rare and, when present, totally weathered. All charcoal samples from the site have been identified as *Tamarix sp.*, characteristic of dry salty soils.

Two burials with anatomically modern *Homo sapiens* (Thoma 1984; Vermeersch *et al.* 1984b, Vermeersch 2002) have been found on the nearby Boulder Hill (Vermeersch *et al.* 1998). Several arguments plead in favour of connecting these burials with the NK-4 mining site. In burial 1 the body is in a contracted position whereas in burial 2, the skeleton was in an extended position. Burial 1 contained, in addition to a very badly preserved skeleton of an adult, the skeleton of a human foetus. A bifacial axe had been deposited, apparently as a burial offering, next to the head of the skeleton in burial 2. Charcoal from burial 1 was dated to 37 570 +350–310 BP (GrA-20145). A tooth fragment from the Nazlet Khater man from burial 2 has provisionally been dated by ESR to 44 ± 6 ka BP (provisional ESR date by R. Grün, at the Research School of Earth Sciences, in the Australian National University in Canberra), which confirms the contemporaneity of the mine and the two burials. From a CT-based imaging of the human from burial 2 (Brünner and Manzi 2002), it is apparent that the cranial morphology exhibits a fully modern architecture, associated with peculiar features that are especially localised in the temporo-mandibular parts, namely the shape of the temporal bones and the proportions of the manibular rami. Also, the internal morphology of these bones displays features that can be considered particular to this specimen. Various regions of the skull show marked patterns of pneumatisation, where enlarged chambers, air-filled contiguous cells, and well developed diploic/spongy tissues characterise the inner volumes. Based on the study (Pinhasi 2002) of the mandible of this human, Pinhasi and Semal (2000) came to the conclusion that there is a clear association between the sub-Saharan MSA specimens and the Nazlet Khater one. Moreover, the Nazlet Khater specimen is clearly not associated with any other North African or Levantine finds.

The flaking technology of the NK-4 assemblage is clearly Upper Palaeolithic in style. The presence of the bifacial technique seems to be a persistence of African influences that are characteristic of some of the Middle Palaeolithic sites in the Nile Valley (Van Peer 1998). The lack of numerous formal tools makes it difficult to integrate the NK-4 assemblage within other Upper Palaeolithic groups of the Eastern Mediterranean. Provisionally, we consider this NK-4 group to be the result of a local evolution within the Nile valley, in isolation from the rest of the Eastern Mediterranean area.

Shuwikhatian

Next in age to NK4 is the Shuwikhatian with the sites of Shuwikhat 1 (Figure

5.1:10) near Qena (Vermeersch *et al.* 2000a), El Adabiya 1 near Danfiq (Vermeersch *et al.* 2000b) and Site E71K9 near Esna (Wendorf and Schild 1976, 83, 244). The Shuwikhat 1–site has been dated by TL on burned clay to 25 ± 2 ka BP (OxTL-253). Site E71K9 has a TL date of 21,5 ± 1.52 ka BP (OxTL 161–C-1) on burned clay from a hearth.

Shuwikhat 1

Shuwikhat 1 (Figure 5.1:10) is located in fine sands and silts of the Shuwikhat Terrace (Paulissen and Vermeersch 1987), which had been formed by aggradation of brown Nile silts, named Shuwikhat Silts, in the Nile valley bottom. The Nile during this time period was a suspended-load river and was aggrading silts over a wide floodplain. In the excavated area, artefact density is high, with up to 2,500 items per square metre. Bone remains are plentiful, but extremely fragmented. An important number of lumps of burned clay has been collected. A vertisol, with its polygonal system of cracks, led to the destruction of possible human occupation structures.

The normal flaking process at the site of Shuwikhat-1 uses opposed platform cores. The technique is clearly a volume-debitage, even if some of the exhausted cores present forms reminiscent of Levallois debitage. Crest preparation is always applied. The production of robust blades is one of the characteristics of the assemblage. These blades (Figure 5.8) have mostly a faceted or flat butt with a prominent bulb. The presence of some butts ‘en chapeau de gendarme’ is suggestive of a careful core edge preparation. Neither Levallois nor Halfan technology has been detected on the sites of the Shuwikhat industry. Nearly all tools are made on blades. The most common tool type is the unilaterally denticulated blade but bilateral ones are also numerous. The bilateral denticulated blades were often made on pointed blade blanks. Burins made on robust blades are numerous. They include burins on a break, burins on truncation, dihedral burins and multiple burins. Endscrapers on a blade are as numerous as burins. Combination tools also occur. Blunting of the proximal end of a blade, a considerable smoothing of the ridge between the striking platform and the flaking surface, is rather frequent. Backed blades are present but not numerous. Borers and truncated pieces are rare. Backed bladelets, Ouchtata bladelets and bifacial pieces are absent.

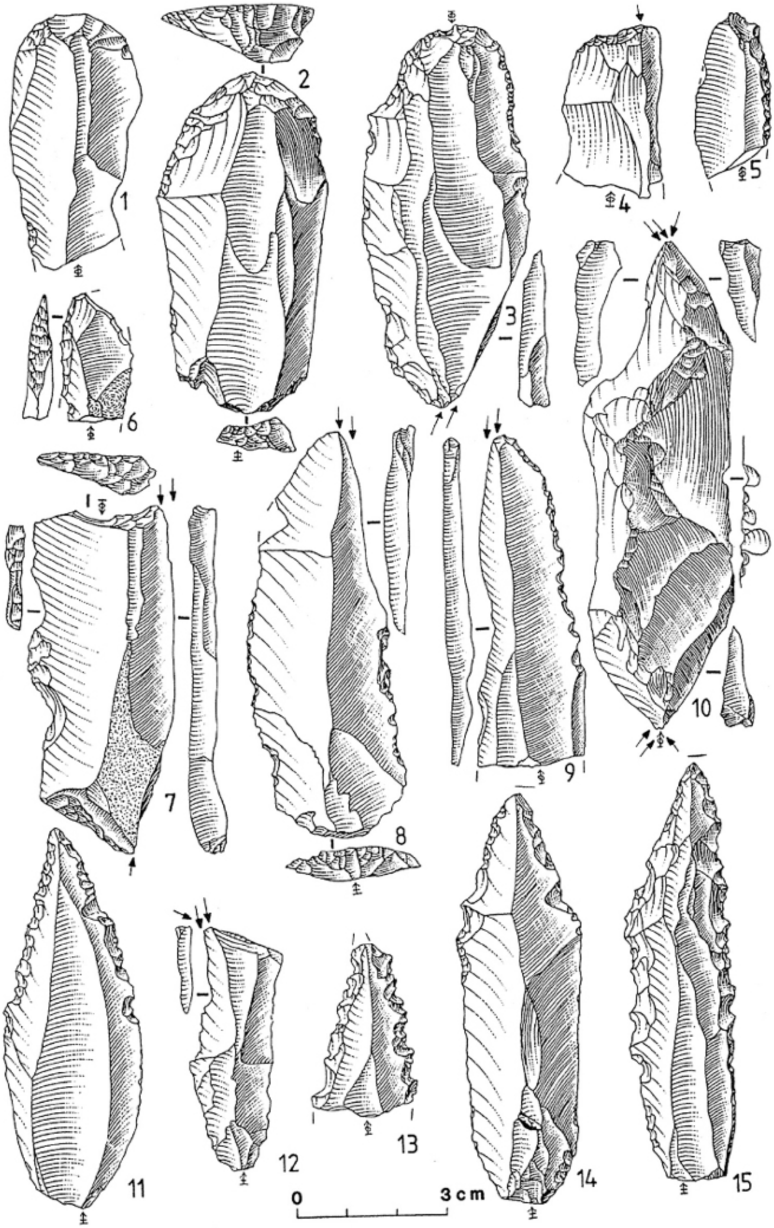

Figure 5.8. Lithic material from Shuwikhat 1 (after Vermeersch et al. *2000a).*

The preponderance of large herbivores, hartebeest and wild cattle, at Shuwikhat 1 must be considered to be the result of differential preservation and hydraulic selection. Most likely, large bovid remains are derived from animals hunted when the Nile had receded and new pasture had become available on the floodplain.

Fishing was probably one of the main subsistence activities.

El Abadiya 1

It is interesting to note that the geographical site location of El Abadiya (Figure 5.1:11) is very similar to that of Shuwikhat: at the edge of the then flood plain. At El Abadiya 1 (Figure 5.1:11), the assemblages from the Central and the Southern Sector were preserved in deposits that are attributed to the Shuwikhat Formation. The artefacts were not any more in an original position but had been instead reworked by colluvial processes.

The use of opposed platform cores for blade production is characteristic of the assemblages (Figure 5.9). At the level of the artefact categories, one noticeable aspect is the small number of cores. Those that are present are of the opposed platform type, and usually of small dimensions. Among the debitage products, blades are well represented. The blades are generally thin and rather short. Butts are mostly plain, although there are some prepared butts. Blunting of the proximal end is represented on both blade and crested blade butts. Tool inventory is poor, but endscrapers, burins and truncations are always among the most important tool categories. Combination tools are also present. Retouched blades (a few Ouchtata-retouched), notched and denticulated blades do occur. The latter are reminiscent of the characteristic heavily denticulated blades of the Shuwikhat 1 assemblage. Next to these tools on blades or flakes, there is a microlithic component in the tool kit: backed and truncated bladelets are present.

The techno-typological features of this assemblage suggest an affiliation with the Shuwikhat 1 assemblage, even if denticulated points are lacking. There are, however, a number of differences in the sense that the debitage products are smaller here than in the eponymous assemblage; moreover, slight differences are noticed in debitage techniques. It is possible, however, that this site may be somewhat younger than 25 ka.

Site E71K9

Site E71K9 (Wendorf and Schild 1976, 83, 244), situated on a flat elongated dune knoll surrounded by Nile clay, about 10 km north of Esna (Figure 5.1:12), has produced very similar assemblages. There is a rich cultural horizon spread throughout a sand layer, of 10 cm to 40 cm thickness, resting on dense brown clay. A TL date on burnt clay from a hearth has been obtained: 21 590 ± 1520 B.P. (OxTL 161.C.1). In 1976, Wendorf and Schild had attributed this and other sites, such as E71P6 and E71P7 from the Esna region, to the non-Levallois Idfuan, which, according to these authors, date to around 17,500 BP. In 1989, F. Wendorf and R. Schild recognised the similarity between Shuwikhat 1 and site E71K9.

The assemblage (Figure 5.10) is dominated by large blades, with numerous denticulates, a variety of well-made burins, retouched pieces, and long, naturally pointed blades with blunting along both edges near the base. Endscrapers and perforators occur in moderate frequencies, while backed blades, scaled pieces, and truncations are rare. There is no indication of Levallois technology or Ouchtata retouch. The resemblance to the artefacts from Shuwikhat 1 suggests that they are part of the same tradition. The faunal remains at E71K9 are also similar to those from Shuwikhat l: numerous bones of hartebeest and wild cattle, with the occasional gazelle, hare, and hyena represented. Catfish were present but not common.

Other Upper Palaeolithic Assemblages?

We should consider also lithic industries from the Nubian Nile Valley, which might eventually date to between 50 and 25 ka BP.

Gemaian

The Gemaian (Figure 5.11) from near Wadi Halfa (Figure 5.1:13) consists of numerous retouched Levallois points struck from small Levallois-point cores mode on Nile pebbles, high frequencies of scrapers and denticulates, together with a few burins, truncations, backed bladelets and Ouchtata bladelets. It probably dates to well before the Halfan (Wendorf and Schild 1989). An exact date is unknown.

Halfan

The Halfan industry (Marks 1968) is mainly restricted to Nubia (Figure 5.1:13). It is a microlithic industry made on small Nile pebbles. One of its characteristic forms is the Halfa flake, produced by a variant of the Levallois technique (Wendorf and Schild 1989). Ouchtata bladelets are equally characteristic. There is a date of 25 700 ± 2500 BP (GXO-410) for the early Halfan site 6B32 (Irwin *et al.* 1968). Wendorf and Schild (1989) reject the date as too old: according to them the radiocarbon determinations of the Halfan suggest an age between 19.5 and 17.5 ka BP.

Sebilian

The Sebilian, with sites near Kom Ombo (Figure 5.1:14) is a flake industry (Figure 5.12) that is not well dated but, according to Wendorf and Schild (1989), should be considered as Late Palaeolithic.

The Late Palaeolithic from Upper Egypt forms a real break with the previous Upper Palaeolithic. From around 22 ka BP, the assemblages are dominated by a bladelet technology, often with Ouchtata retouch (Wendorf and Schild 1976, 1989). There seems to be a reintroduction of Levallois technology.

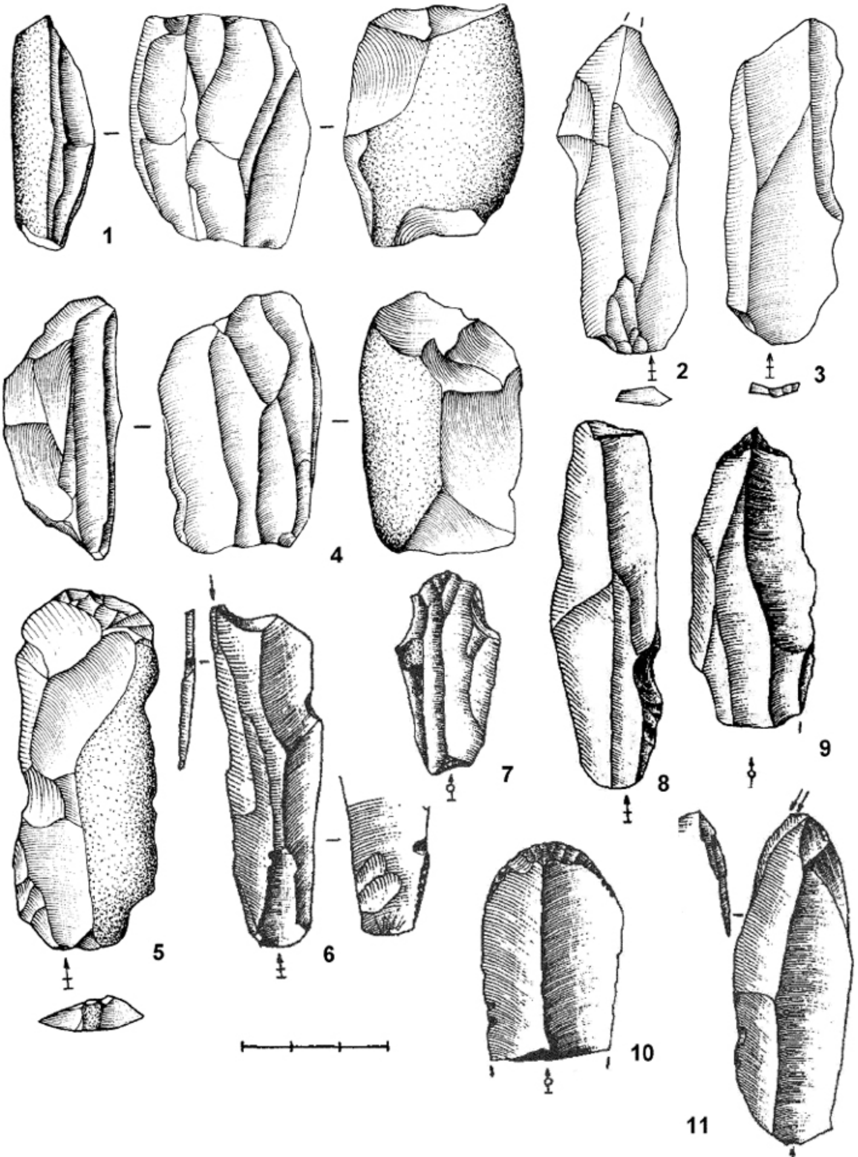

Figure 5.9. Lithic material from The Shuwikhatian site Al Abadiya 1 (after Vermeersch et al. 2000b).

The western desert

If we take into account that an extreme arid climate prevailed during the period from about 60 ka until 11 ka BP (Wendorf *et al.* 1993), it is hardly surprising that information related to the human occupation of the area from 50 to 25 ka BP is restricted. The Middle Palaeolithic population that was present all over the different oases and the playas during the previous OIS 5 and the beginning of OIS 4 disappeared from the eastern Sahara (Wendorf *et al.* 1993). Groups that had developed an Aterian technology moved, already before 50 ka BP, into North and West Africa, where their presence is certainly attested to at a more recent period than in the Eastern Sahara (Van Peer 1998).

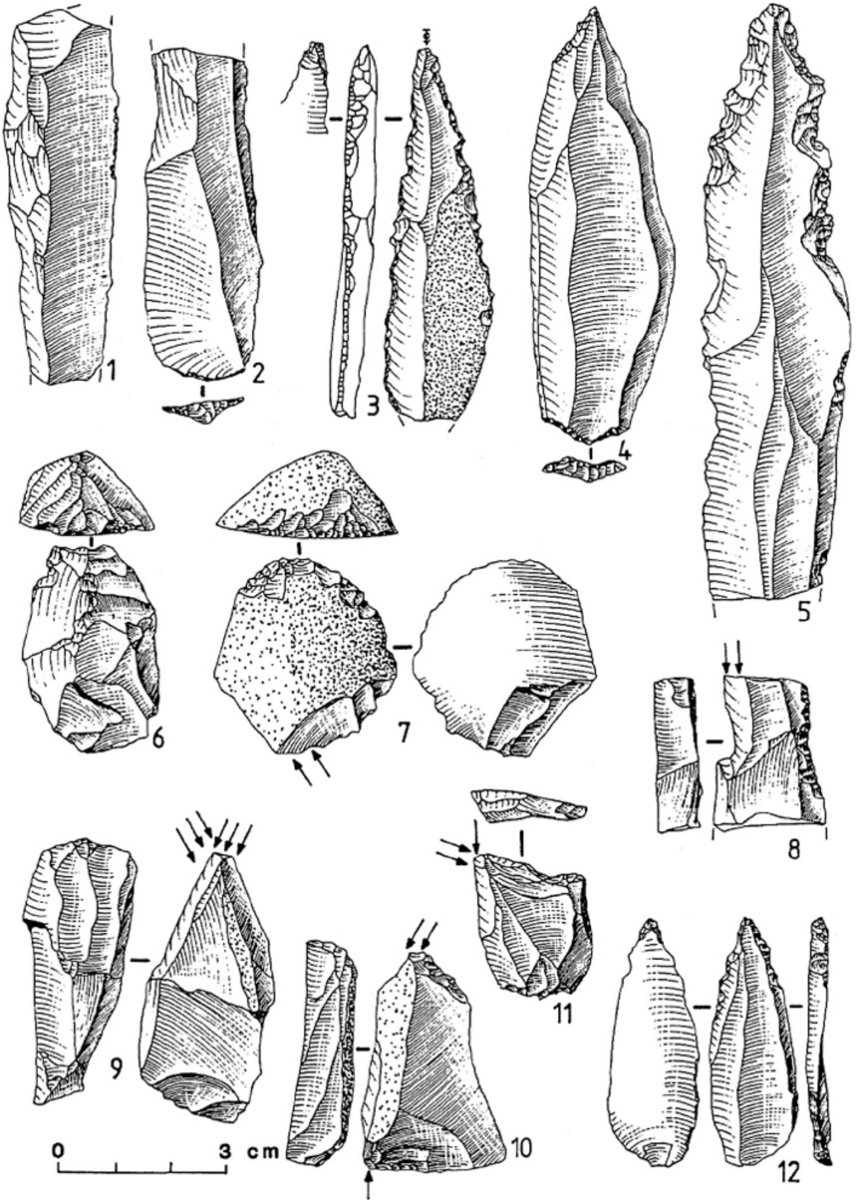

Figure 5.10. Lithic material from the Shuwikhatian site E71K9 (after Wendof and Schild 1976).

The climatic deterioration in the area (Wendorf *et al.* 1993) prompted a withdrawal of all human occupation of the area. Surveys for sites from the period 50–25 ka BP are, however, still very restricted in the Eastern Sahara and this may at least partially explain the absence of known sites. Wiseman (1999) adopts the view that, although secure dates remain elusive, technological and stylistic attributes of the lithic artefacts found in and around Dakhleh Oasis (Figure 5.1:15) support the hypothesis that humans were indeed present during this time-span. The presence of tufas indicates that springs were active along the Libyan Escarpment at different times, perhaps inclusive of the last 30,000 or 40,000 years. Some cores, two endscrapers and a burin on a truncated blade were found on gravels north of Bashendi. On typological grounds alone this locality might fall into the later Late Pleistocene time-range and, as such, appears worthy of further investigation. One could also refer to Caton-Thompson's (1946, 1952) 'Epi-Levalloisian' from the Fayum (Figure 5.1:19) and the Khargan from the Kharga Oasis (Figure 5.1:17), which she considered to be Upper Palaeolithic.

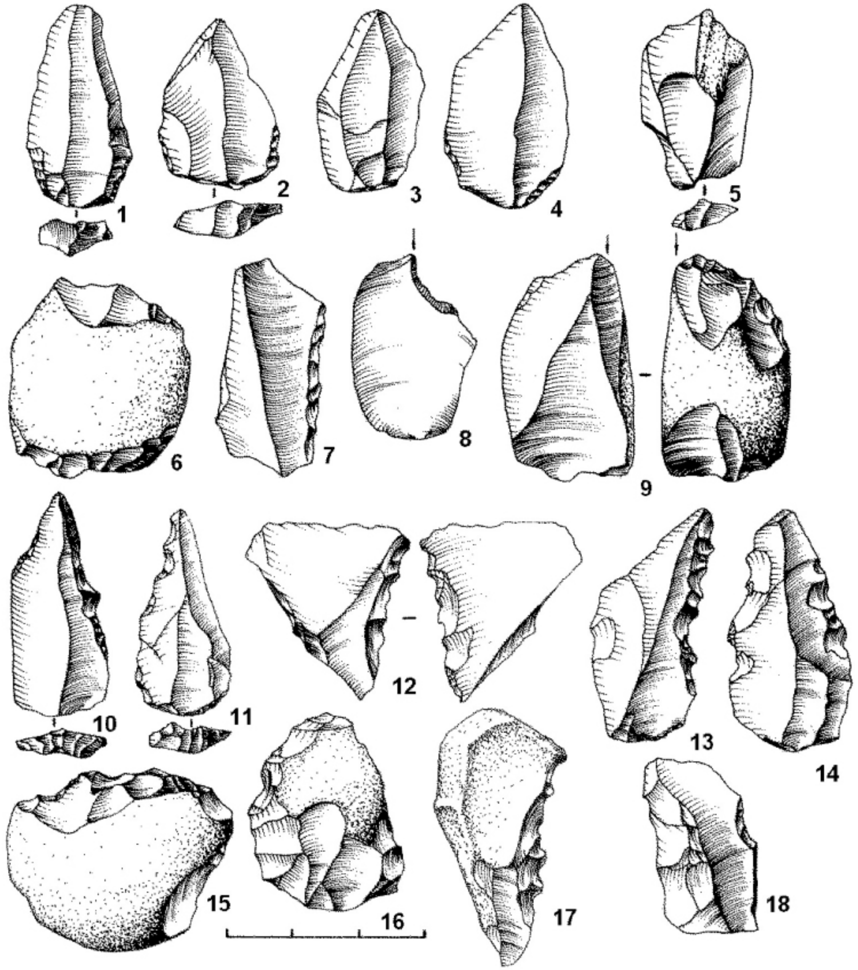

Figure 5.11. Lithic material from the Gemaian site 1025 (after Shiner 1968).

Around the playas of the El-Hayz area, Baharia oasis (Figure 5.1:16), Barta *et al.* (2003) encountered rather small-dimensional Levallois and blade industries. They recorded the presence of retouched tools such as bifacial leafpoints, burins, sidescrapers, and borers. They interpret this typological structure, together with the smaller size of cores and flakes and an increased amount of blades, as an indication that this horizon is situated somewhere around the Middle-to-Upper Palaeolithic transition, roughly contemporaneous with the "Khargan" or Aterian technocomplexes.

All this remains, unfortunately, rather speculative and there is no doubt that until now no sites from the western desert have yielded a good image of groups dated to between 50 and 25 ka BP. For the time being, no proof of human presence in the period under consideration is available.

The eastern desert with the Red Sea Mountains

In the Eastern Egyptian desert, only a single site provides some information for the time period considered. Indeed, Sodmein Cave (Figure 5.1:18) has an important succession of human occupations (Van Peer *et al.* 1996). Below the Neolithic occupation, seven Palaeolithic levels are distinguished, two of which are attributed to the Upper Palaeolithic. The Upper Palaeolithic level 1 is a very poorly documented level. A few blades and cores are present. The latter are flat discoidal cores for flake production. The presence of some worn older artefacts may point to a substantial reworking of this level. It is possible that this level is in fact nothing more than a redeposited part of the underlying level 2. The Upper Palaeolithic level 2 is one of the richer occupation levels. In the northern zone of the cave, an important accumulation of lithics occurred around a hearth for which an AMS-radiocarbon date of 25 200 ± 500 (UtC-3313) has been obtained on charcoal. Numerous blades (Figure 5.13), with almost exclusive unidirectional dorsal scar pattern, are present. Butts are generally unprepared. Cores with one striking platform exhibit evidence of regular blade production. There is no trace of Levallois technology. Tools are extremely rare but include some burins.

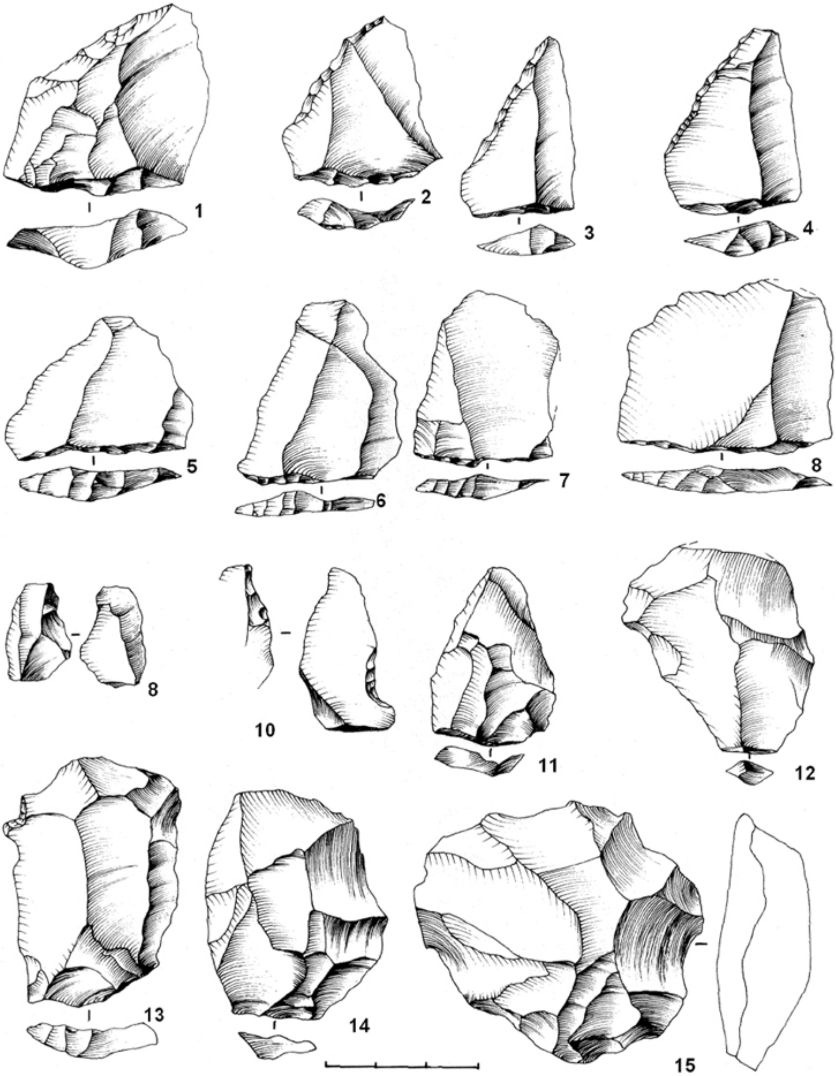
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Figure 5.12. Lithic material from the Sebilian site 1024A (after Marks 1968).

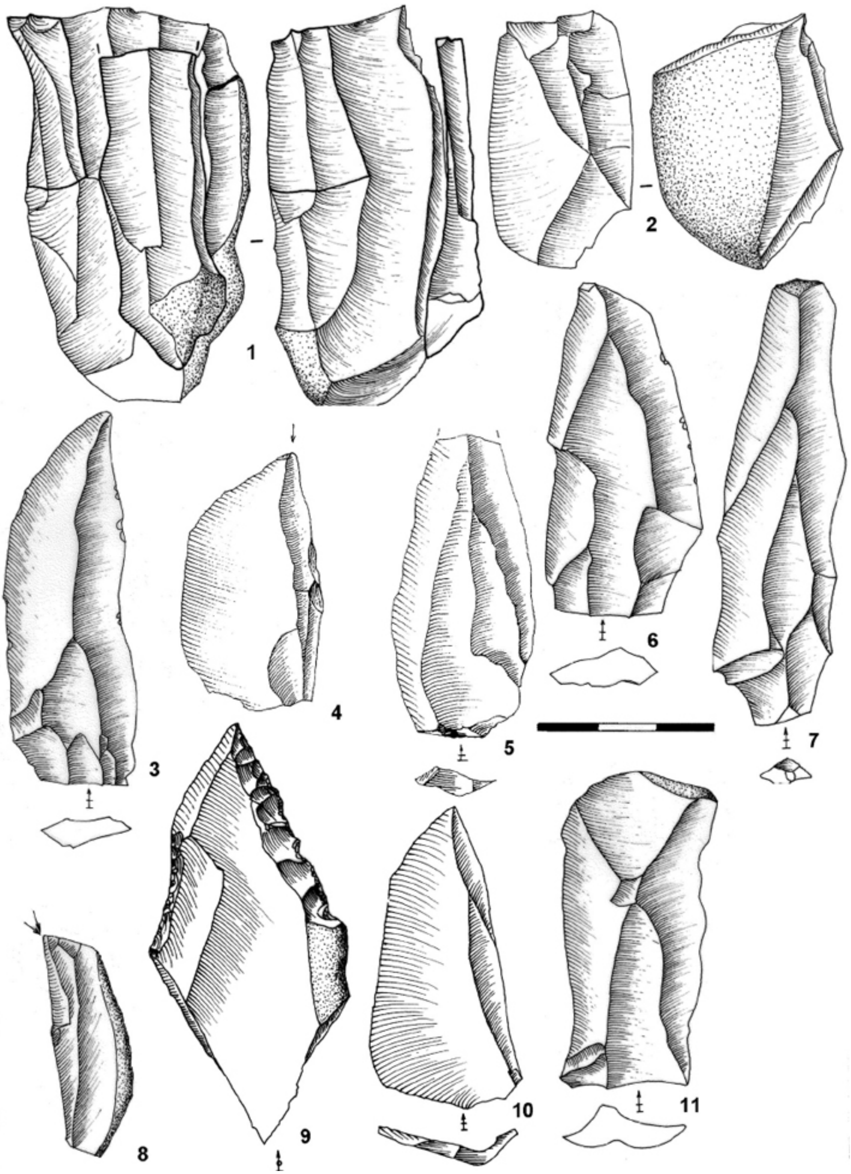

Figure 5.13. Lithic material from Sodmein Cave, Upper Palaeolithic Level 2 (after Van Peer et al. 1996).

Conclusions

From this review it is clear that nearly all data from the period considered are related to Upper Egypt and the Sinai. This is probably due to the extreme dryness of the climate for the areas outside the Nile Valley and to the burial of Upper

Palaeolithic remains by the Holocene Nile deposits for Lower Egypt.

For the Sinai there is no evidence for a human presence in the period before 40 ka. Later, the early Upper Palaeolithic human presence (Lagaman) is clearly associated with the Mediterranean Levantine situation. The Lagaman is considered as belonging into the Ahmarian.

In Upper Egypt there are clear indications of a transition from Middle Palaeolithic-style assemblages to Upper Palaeolithic ones (Taramsa 1). They are probably older than 45 ka BP. Such transitional assemblages have their roots in the local Middle Palaeolithic of the Lower Nile Valley Complex. No connections have as yet been found with what happened in the Mediterranean Levant. From 35 ka onwards, another type of blade technology (NK-4) with its roots in the southern Middle Stone Age traditions (bifacial technology along with blade technology) is known only from a few sites. Egypt, in this period, seems to be looking more to the South than to the Mediterranean.

Around 25 – 22 ka, the Shuwikhatian is a blade industry with typical Upper Palaeolithic tools. The Shuwikhatian forms probably the final stage in an evolution out of the Middle Palaeolithic, and specifically the Lower Nile Valley Complex, which is characterised by the classical Levallois method (Van Peer 1991). Hypothetically, we consider the Shuwikhatian as the result of a local evolution in the Egyptian Nile valley. The Shuwikhatian has some clear similarities regarding the tool typology with Boker Tachtit, level 4 (Marks 1983b), especially with the endscrapers and the burins and the absence at both sites of El Wad points. Points are present at Shuwikhat 1 but they are pointed blades rather than real Boker Tachtit points. The technology of blade production is, however, entirely different. The crest preparation, very characteristic at Shuwikhat 1, is lacking at Boker Tachtit, level 4. The Shuwikhatian presents a few similarities with the Ahmarian but is still very different in its tool typology and in the complete absence of El Wad points. The knapping techniques of the Shuwikhatian are completely different from those of the Nazlet Khater 4 assemblage. Taking into consideration important differences in blade technology between the Shuwikhat 1 and the NK4 assemblages, we presume that there is no genetic link between them.

Upper Egypt has no clear connections with the rest of the Eastern Mediterranean. The Upper Egypt situation is also different from that of the southern Middle Nile Valley where there seems to be a continuous use of the Levallois technology during the Upper Palaeolithic period. In light of what is known about the Final Palaeolithic, however, when Levallois debitage is continuously present in several assemblages in Upper Egypt (Wendorf and Schild 1976, 1989), it is conspicuous that this technique is lacking in the two Upper Palaeolithic industries of Egypt. In this respect, the Nazlet Khater 4 industry and the Shuwikhatian fit better with the Eastern Mediterranean situation, where the Levallois method disappeared during the Upper Palaeolithic. Direct connections with the Mediterranean Levant, however, seem to be restricted. Within the framework of North Africa and southwest Asia, the Upper Palaeolithic of Upper Egypt seems to be rather insular.

During the whole period from 50 to 25 ka BP, population density in Egypt was apparently very low and probably restricted to the Sinai and the Nile valley, where only in Upper Egypt are there a few sites found.

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6. The Shift from the Middle Palaeolithic to the Upper Palaeolithic: Levantine Perspectives

Anna Belfer-Cohen and A. Nigel Goring-Morris

ABSTRACT

Notwithstanding the shift from flake to blade/bladelet based industries, the early Upper Palaeolithic in the Near East actually displays considerable evidence for continuity from the preceding local late Middle Palaeolithic in terms of the lithic assemblages. Technological developments primarily focused on the specifics of core preparation, leading to the production of more, thinner, blanks per unit volume of raw material. This broadly parallels the behavioural changes associated with modern humans, which also appear to be generally incremental. It seems that being considerably later, the Levantine Aurignacian, intrusive to the area, is irrelevant to the present discussion.

Introduction

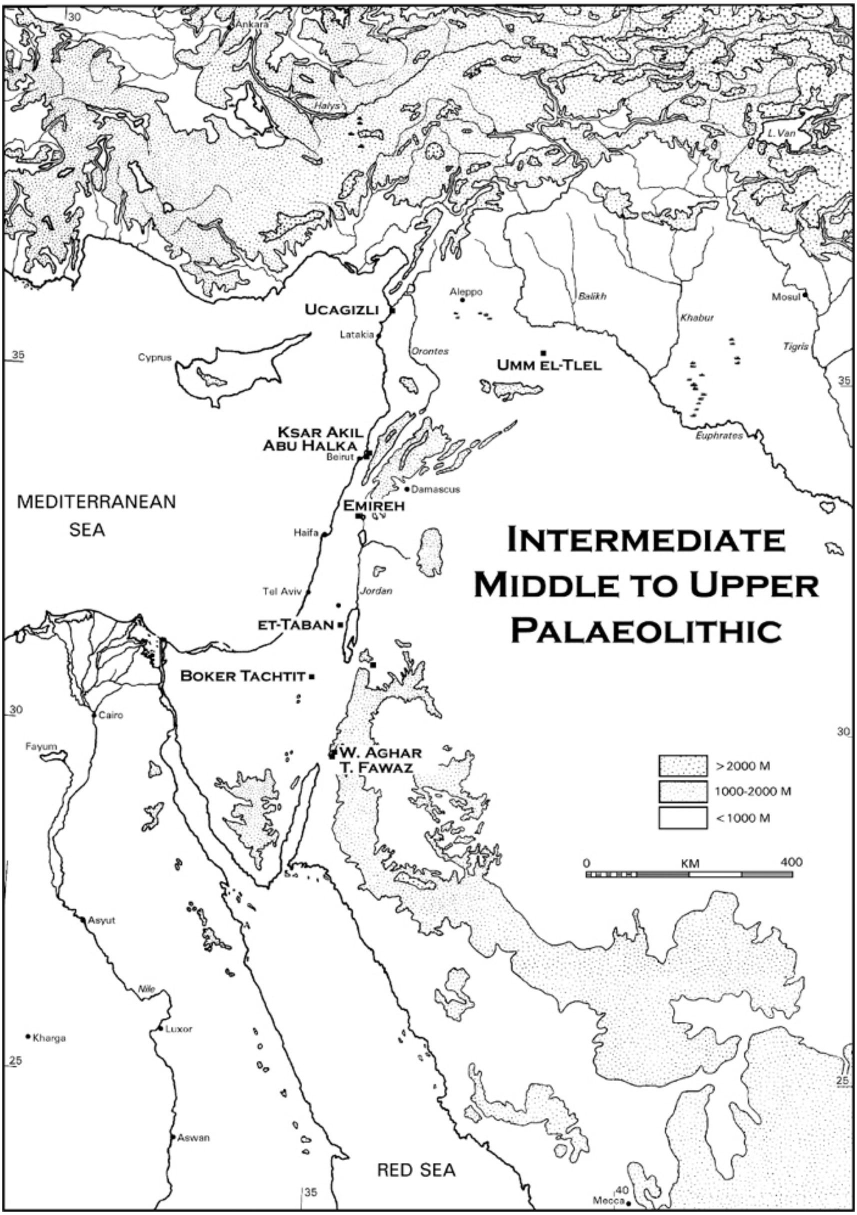
The shift from the Middle to Upper Palaeolithic had profound implications as regards so-called modern human behaviour together with evolutionary trends at macro or global levels (and see contributions in Hoffecker and Wolf 1988; Mellars and Stringer 1989; Trinkaus 1989; Orschiedt and Weniger 2000; Zilhao and d'Errico 2003a, b, to mention but a few). In the following note we wish to address the issue of Middle to Upper Palaeolithic continuity and change from the perspective of the Near East, most especially the southern Levant (Figure 6.1).

The interaction between Neandertals and Modern humans at the Middle to Upper Palaeolithic interface in the Levant seems to be less rigid than that observed elsewhere in the Old World (for details and diverse opinions see Mellars *et al.* 1999; Zilhao and d'Errico 1999, 2003a; Mellars 2004). Indeed, the material culture evidence, primarily lithics, would tend to support a rather gradual, local shift through time, in contrast to that observed in the Western European Middle to Upper Palaeolithic transition. Perhaps this ties in with the notion that the Late Mousterian 'Neandertal' population in the Levant had contacts with the Modern humans who locally preceded it, *e.g.* the Middle Palaeolithic human remains from Qafzeh and Skhul. Alternatively, this could also reflect interactions with contemporaneous neighbouring populations in North Africa and the Nile Valley, which most probably comprised Modern human communities (Arensburg and Belfer-Cohen 1998). Hence the situation differs from that in Western Europe, where the local Neandertals evolved under conditions of near isolation (for overviews see Hublin 2000; Orschiedt and Weniger 2000; Trinkaus 2001; and references therein).

Bearing these remarks in mind, a focal issue of prehistoric research has been the nature of the observed changes. Were the processes of change abrupt, so that little, if any continuity can be observed between Middle and Upper Palaeolithic entities? Or, alternatively, should we acknowledge apparent continuity between the two periods, such that the relevant prehistoric entities displayed similarities and continuities in their material culture properties? Of course, another option is to assume the presence of an interim phase, comprising characteristics of both the Middle and Upper Palaeolithic, thus straddling the two.

Traditionally, it was implicit that within the Levant the Middle to Upper Palaeolithic shift involved the existence of a transitional entity and, since the Middle Palaeolithic supposedly differed greatly from the Upper Palaeolithic, it was only through the 'transitional' industries that one might observe the co-existence of these different characteristics.

A plethora of new data have accumulated over the last 30 years or so, accompanied by significant advances in the realm of prehistoric research theory. These have stimulated numerous studies evaluating the established course of events as regards the Middle to Upper Palaeolithic interface (and see for example the articles in Carbonell and Vaquero 1996; Bar-Yosef and Pilbeam 2000; Zilhao and d'Errico 2003a, and references therein). It is within the framework of these discussions that we would like to present our ideas from a Levantine perspective.



INTERMEDIATE MIDDLE TO UPPER PALAEOLITHIC
UCAGIZLI
UMM EL-TLEL
KSAR AKIL
ABU HALKA
EMIREH
ET-TABAN
BOKER TACHTIT
W. AGHAR
T. FAWAZ
MEDITERRANEAN SEA
RED SEA
Ankara
Halys
L. Van
Aleppo
Balikh
Mosul
Khabur
Tigris
Latakia
Orontes
Cyprus
Euphrates
Beirut
Damascus
Haifa
Tel Aviv
Jordan
Cairo
Fayum
Asyut
Nile
Luxor
Kharga
Aswan
Mecca
30
35
40
25
>2000 M
1000-2000 M
<1000 M
0
KM
400

Figure 6.1. Distribution map of Intermediate/Middle to Upper Palaeolithic occupations in the Levant.

Firstly, we would like to discard the use of the term ‘transitional’ and all that it implies. We believe that this term should refer to only a brief interlude of dynamic change. However, the duration of the so-called transitional phases in the Levant, from Boqer Tachtit through Uçagizlı, is at least 5,000 radiocarbon years (from 45± thru 40± Ka years) and, if we cite Kuhn (2003), this interval may have lasted for as long as 10,000 radiocarbon years and perhaps much longer, taking calibration into account (Beck *et al.* 2001).

When carefully checked and evaluated the changes observed in the main archaeological component, namely the lithics, are more incremental than has been commonly portrayed. The Levantine Mousterian has been invariably characterized in terms of the Levallois technique. Once this technique disappeared in its most obvious manifestation, it was widely assumed that this *modus operandi* was rapidly replaced by a supposedly quite different, Upper Palaeolithic blade technology. Thus these occurrences paralleled similar, though later technological developments in Europe (see Bar-Yosef 2002 for history of research). But, in reality, the Levantine Mousterian notion of a pre-planned, prepared core technology actually continues into the Upper Palaeolithic. Accordingly, the early Upper Palaeolithic blade technology should be viewed as modifications of earlier Middle Palaeolithic technologies, or, and perhaps more importantly so, of the underlying *concepts* associated with these technologies. An apt illustration of this issue is the use of Middle Palaeolithic 'Nubian' opposed platform technology in the 'Intermediate/ Early Upper Palaeolithic' assemblages of Boqer Tachtit (see Figure 6.2:1–6, 12–16; and also Guichard and Guichard 1965; Tixier *et al.* 1980).

The overall result is thus transitional only in retrospect, and we therefore believe the term 'Transitional' should be replaced. Instead the expression 'Intermediate phase' more closely reflects matters (yet another suggestion, synonymous with Kuhn's (2003) 'Initial' Upper Palaeolithic). Indeed we clearly have 'genuine' intermediate entities in the Levant, in the sense that they comprise local and regional Middle and Upper Palaeolithic elements on the same pieces (Figure 6.2:7–11).

The earliest fully-fledged Upper Palaeolithic entity in the Levant is the Early Ahmarian, dating from *ca.* 40 Ka years onwards, while the Levantine Aurignacian (resembling the Western European Aurignacian stages I and II, *grosso modo*) is much later in time (dating to *ca.* 28± Ka years) (Bar-Yosef 2000, 2002; Belfer-Cohen and Goring-Morris 2003; Goring-Morris and Belfer-Cohen 2006). Moreover, while there is a consensus of opinion that the Ahmarian is distributed throughout the entire Levantine corridor (Figures 6.3–6.4), the Levantine Aurignacian, *sensu stricto*, is limited to but a brief sojourn (*ca.* 30–27 Ka years – see Appendix in Goring-Morris and Belfer-Cohen 2003) in the Mediterranean littoral and occurs only sporadically, if at all, elsewhere (Figure 6.5). We should note that there is and has been a long-running general consensus that the Levantine Aurignacian, whichever definition is used, has nothing whatsoever to do with the local Middle to Upper Palaeolithic transition (from the early articles of Gilead 1981; Marks 1981 through the overview of Bar-Yosef 2000; detailed discussion in Goring-Morris and Belfer-Cohen 2006 and see articles in Goring-Morris and Belfer-Cohen 2003). This is quite obvious given the chronological disparity between the appearance of the earliest Upper Palaeolithic cultures and the Levantine Aurignacian (and see Figure 6.6).

The elements of Middle to Upper Palaeolithic continuity in the assemblages of the 'Intermediate' (pre- or proto-Ahmarian) phase are quite obvious and indeed were recognized by both D. Garrod (1938, 1954) and R. Neuville (1951) as indicated by their original terminologies – the ‘Emiran’ or ‘Phase I’ of the Upper Palaeolithic. This has also been observed recently by A. E. Marks (2003), who recognizes a high degree of continuity in his newly defined ‘Leptolithic lineage’, which begins in the Middle Palaeolithic and ends during the Epipalaeolithic. It accordingly incorporates the entire Ahmarian/local Upper Palaeolithic sequence (*sensu lato*), but excludes all that was in the past labeled as Levantine Aurignacian (*sensu lato*).

Considerable continuity in lithics has thus been documented. In the past most lithic studies entailed morphometric, *i.e.* typological comparisons. Later on, it was the technology, studied by what has been considered as scientifically appropriate, *i.e.* quantitative methods. More recently, a wider range of technological methodologies has been developed, namely the reduction sequence as part of the *chaîne opératoire* approach, sometimes involving systematic refitting studies (Volkman 1983; Becker 2003; Davidzon and Goring-Morris 2003; Monigal 2003; Skrdla 2003).

Nevertheless, attempts to combine the *chaîne opéra-toire* approach with a rigorous scientific methodology have sometimes resulted in what we believe to be exaggerated quantification of the various observed components, which are then integrated to provide such indices as the “Total Measure of Difference Weighted by Behavioral Domains” (Tostevin 2000, 2003). Micro- or almost nano- approaches can be quite helpful when processing a plethora of data, accurately documenting the specific case/s at hand. Yet, ultimately, they skirt and avoid addressing the broader panorama, ‘sweeping under the carpet’ the archaeological reality of unknown, unavailable, or unquantified and unquantifiable factors. We wonder how some of these numeric values ascribed to observed lithic phenomena relate to actual prehistoric human behaviour at both individual and group levels, within their intricate and poorly understood specific contexts. Perhaps instead, we should re-appraise matters from a relatively more simplistic perspective. Indeed, this approach is valid in the ‘hard-core’ sciences, where we can take heart from the study of human cognition, which has established that most crucial decisions are often made intuitively, *i.e.* on the basis of general ‘life experience’, including ‘trial and error’, ‘common sense’, ‘personal experience’ and the like (Bechara *et al.* 2000; De Martino *et al.* 2006; Shanks *et al.* 2006).

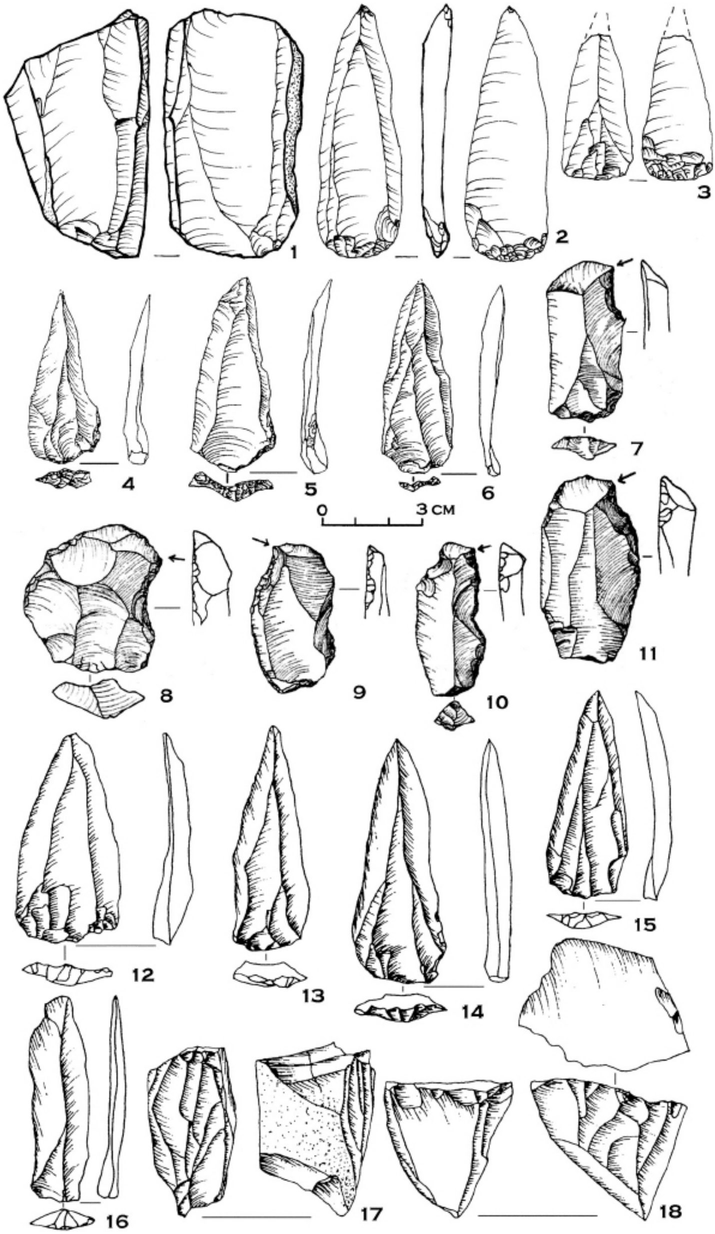

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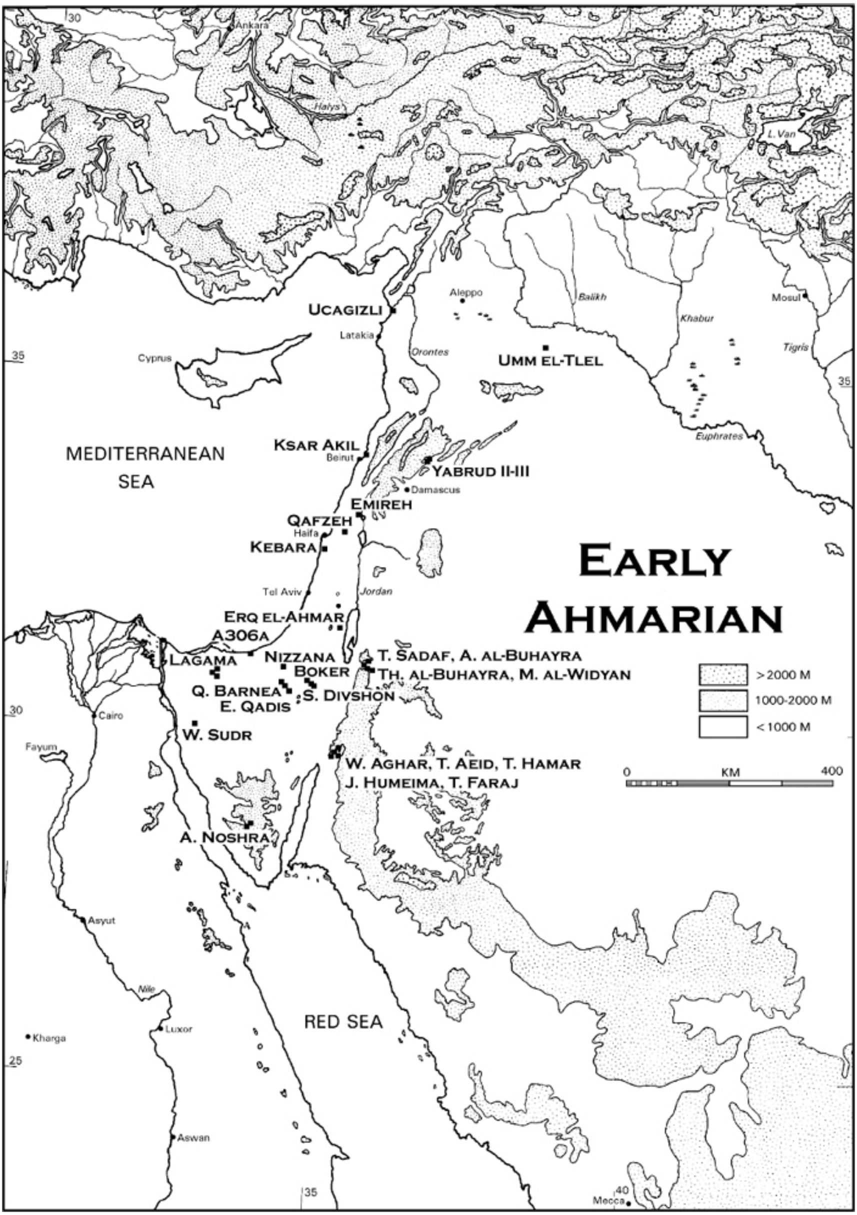
Figure 6.2. Typical artefacts of Intermediate/Middle to Upper Palaeolithic industries. 1, Nubian Levallois core; 2–3, Emireh points; 4–6, 12–16, Levallois type points; 7–11, chanfreins on faceted blanks; 17–18, cores. (1–6, after Marks and Kauman 1983; 7–11 after Newcomer 1968–9; 12–18 after Bar-Yosef 2000).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Cyprus
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Euphrates
Ksar Akil
Beirut
MEDITERRANEAN
SEA
Yabrud II-III
Damascus
Emireh
Qafzeh
Haifa
Kebara
Early
Ahmarian
Tel Aviv
Jordan
Erq el-Ahmar
A306a
Lagama
Nizzana
Boker
T. Sadaf, A. al-Buhayra
Th. al-Buhayra, M. al-Widyan
Q. Barnea
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Mecca

Figure 6.3. Distribution map of Early Ahmarian occupations in the Levant.

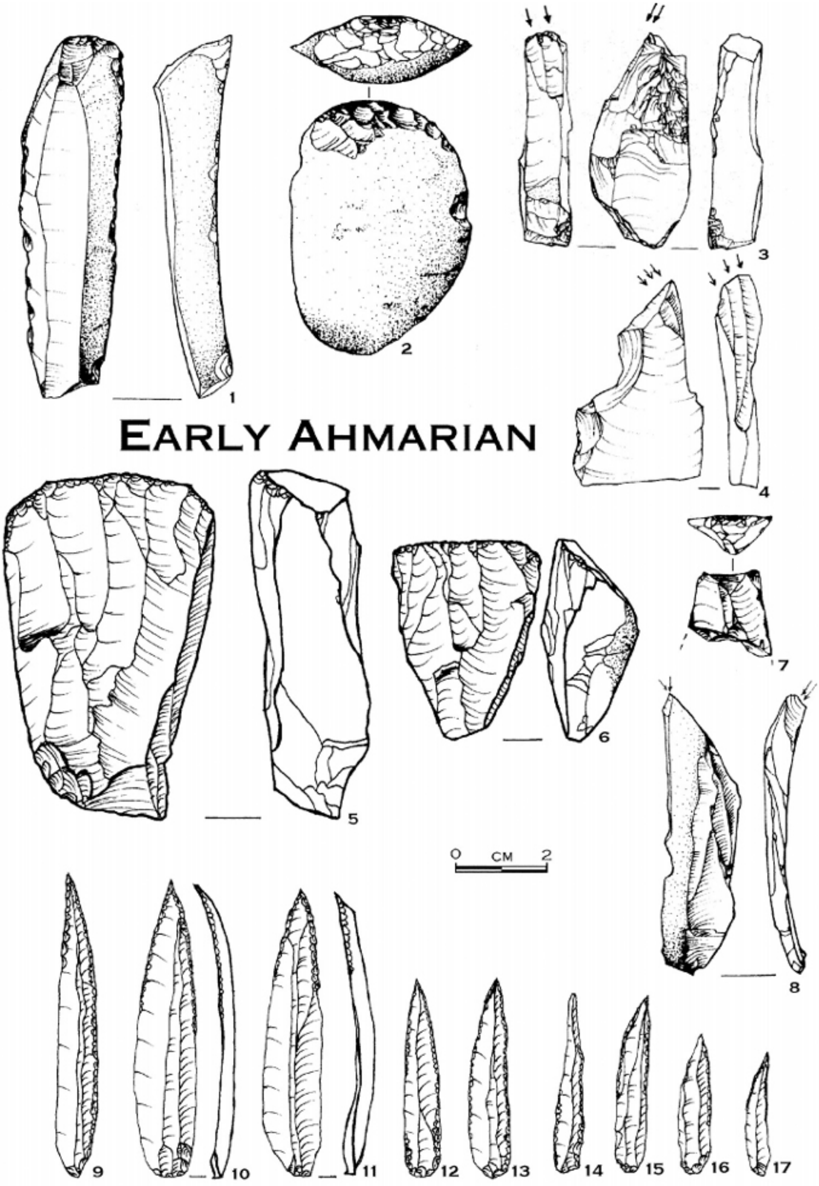
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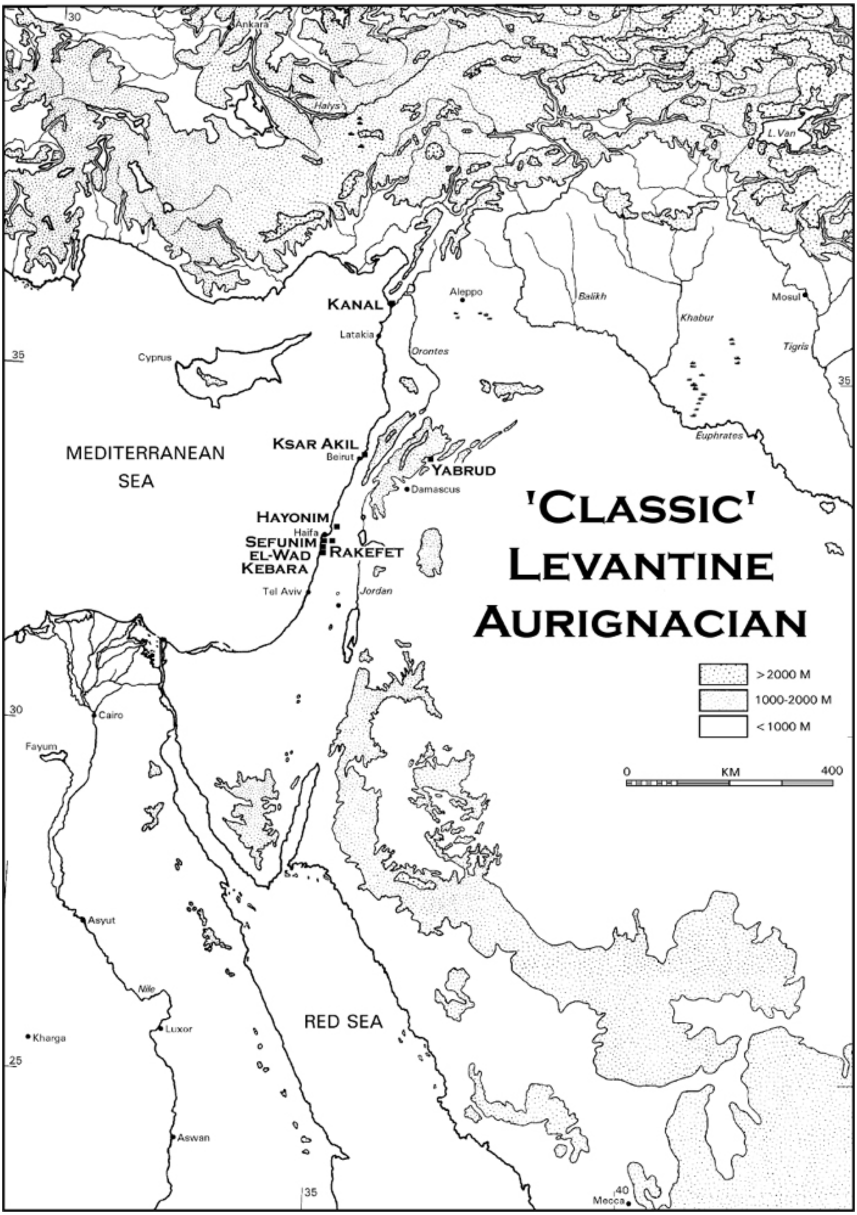
Figure 6.4. Typical Early Ahmarian toolkit: 1–2, endscrapers; 3–4, 8, burins; 5–6, unipolar N-fronted blade/let cores; 7, concave truncation; 9–17, el-Wad points and pointed bladelets. (1–2, 5–8, after Goring-Morris 1995; 3–4, after Bar-Yosef and Belfer-Cohen 2005; 9–17, after Belfer-Cohen and Goring-Morris 2002)..

So, what are the pertinent differences and similarities observed between the late Middle Palaeolithic and the Intermediate, Initial or earliest Upper Palaeolithic in the Levant? We refer here only to the lithics, fully aware that there were other elements of the material remains that reflected new behavioural developments, *e.g.* ornaments as expression of social identity (see Kuhn *et al.* 2001):

1. It is important to emphasize that Intermediate/Early Upper Palaeolithic assemblages are characterized by technological continuity, yet also by typological replacement and change. This is most obviously illustrated by the continued use of faceting as part of setting up the core for blank production (Marks and Kaufman 1983; Bourguignon 1996, 1998; Fox 2003; Kuhn *et al.* 2003; Fox and Coinman 2004).
2. Technologically, the shift from a ‘surficial’ approach to a ‘volumetric’ one as represented by the Ahmarian N-fronted core (Figure 6.7; Davidzon and Goring-Morris 2003; Goring-Morris and Davidzon 2006) is perhaps less radical in the Levant than is often depicted in Europe, where the rupture between the Middle and Upper Palaeolithic is marked (*e.g.* Geneste 1988; Boëda 1990).
3. Endscrapers seemingly replace the typical Middle Palaeolithic sidescraper class (in the southern Levant the latter were never very plentiful). By way of example, at Boqer Tachtit the frequencies of endscrapers rise from 9.8% in Level 1 (early) to 22.1% in level 4 (late) while sidescrapers disappear altogether (Marks and Kaufman 1983).
4. Burins appear in much larger quantities than previously.
5. A new tool form, the *chanfrein* of the north Levantine coastal plain, combined elements of both, scraper and burin, and perhaps functioned as a chisel or wedge (Figure 6.2:7–11; Newcomer 1968–9). Many *chanfreins* appear on faceted items. Ultimately, this new type was not a ‘successful’ innovation, since it rapidly disappeared, only to re-appear many tens of millennia later during the Neolithic (see Crowfoot 1936).
6. Levallois points are replaced by other types of projectile. They display subtle, though profound, changes in specific techno-typological aspects. These changes include a shift in the specifics of blank production, to abrasion of the removal surface rather than platform faceting prior to removal of the blank (indicating somewhat more sophistication in terms of forward planning in the sense of being able to produce more items in series per unit volume – and see point 9 below) (Figure 6.7). It is rather difficult to determine unequivocally whether this change also entailed a change in the percussor type – from hard to soft hammerstone. Nevertheless the intermediate form, the Emireh point, likely provides some indication as to the logic involved in this shift, since it is typified by basal thinning, most probably to facilitate hafting (Figure 6.2:2–3).
7. Indeed it seems to us that hafting played a crucial role in several of the observed changes, since many of the more successful innovations appear to have involved the manner in which stone tool types, especially projectile points were hafted, as well as the manner in which they were propelled (Bergman and Newcomer 1983; Friedman *et al.* 1995; Boëda *et al.* 1996; Plisson and Beyries 1998; Belfer-Cohen and Goring-Morris 2002).
8. Most Upper Palaeolithic points did not necessarily end up absolutely longer than the earlier Mousterian varieties, but they do seem to have ended up thinner and narrower, *i.e.* they become more gracile and lighter (Bergman 1981).
9. Bifacial thinning was rapidly replaced by abrasion of the removal surface of the

core. This was only a low-key innovation, although it actually represents a ‘magic’ password to many other technological innovations and related improvements. Abrasion and removal from a narrow-fronted core enables more efficient exploitation of the initial volume of the nodule. This leads to the production of more functional blanks per unit volume, which can actually be described as a conceptual refinement of the Levallois ‘*recurrent*’ approach (Figure 6.7; Davidzon and Goring-Morris 2003).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Ankara
Halys
L. Van
Aleppo
Balikh
Mosul
Kanal
Khabur
Latakia
Tigris
35
Cyprus
Orontes
35
Euphrates
Ksar Akil
Mediterranean
Sea
Beirut
Yabrud
Damascus
'Classic'
Levantine
Aurignacian
Hayonim
Haifa
Sefunim
el-Wad
Rakefet
Kebara
Tel Aviv
Jordan
> 2000 M
1000-2000 M
< 1000 M
30
Cairo
0
KM
400
Fayum
Asyut
Nile
Red Sea
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Aswan
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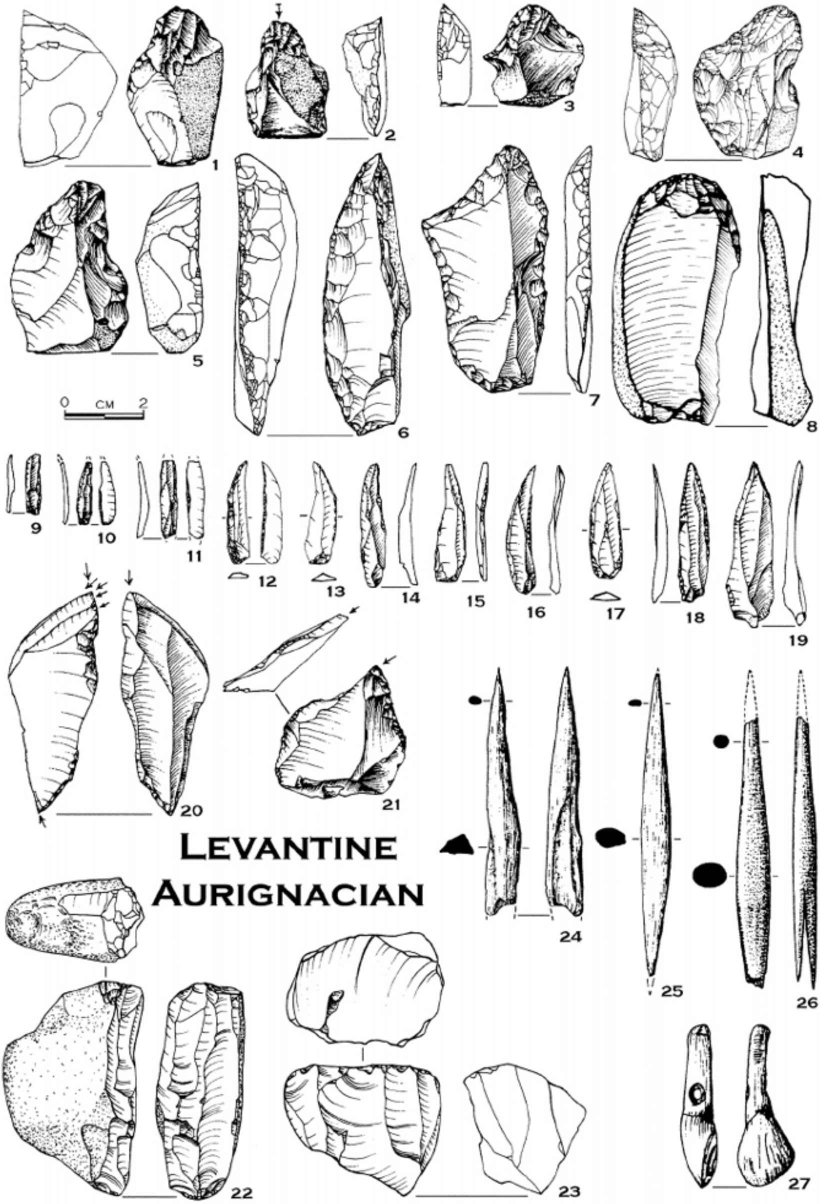
40
Mecca

Figure 6.5. Distribution map of Levantine Aurignacian (sensu stricto) occupations in the Levant.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LEVANTINE AURIGNACIAN
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Figure 6.6. Typical 'classic' Levantine Aurignacian toolkit: 1–5, 7, nosed and shouldered scrapers; 6, Aurignacian blade; 8, endscraper; 9–16, Dufour bladelets sensu lato; 17–19, points; 20–21, burins; 22–23, cores; 24, bone point; 25 antler bi-point; 26, split-base bone point; 27, equid tooth pendant. (Modified after Bar-Yosef and Belfer-Cohen 1996).

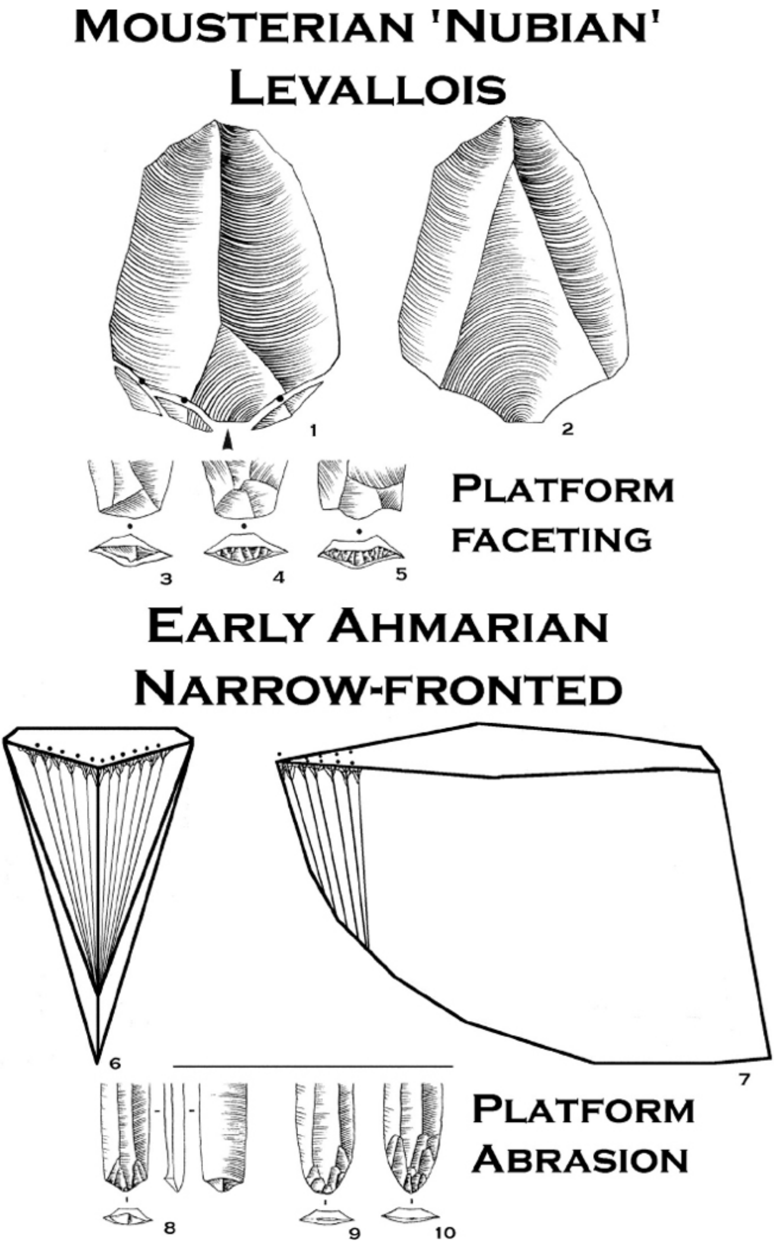
MOUSTERIAN 'NUBIAN'
LEVALLOIS
1
2
3
4
5
PLATFORM
FACETING
EARLY AHMARIAN
NARROW-FRONTED
6
7
8
9
10
PLATFORM
ABRASION

Figure 6.7. The technological shift from core platform faceting in the Middle Palaeolithic to removal surface preparatory abrasion in the Upper Palaeolithic. Note the shift from a 'surficial' to a 'volumetric' concept as represented by the 'N-fronted' core (after Tixier et al. 1980, figs. 9 and 47; and Davidzon and Goring-Morris 2003).

In summary, one can safely state that the basic Initial Upper Palaeolithic characteristics did not stray far from the underlying Mousterian concept and, techno-typologically-speaking, it all 'stayed in the family' until much later, with the arrival in the Levant of the 'distant' Aurignacian cousins. They stayed but for a short while, bringing with them completely new technological concepts and a different typological repertoire (Figure 6.6). For example, Aurignacian projectile points appear to have been primarily fashioned on different, organic, raw materials, *e.g.* horn core, bone (Figure 6.6:25–26; Bergman 1987).

Overall it seems to us that the passage from Middle to Upper Palaeolithic in the Levant was indeed less dramatic than that which is assumed to have occurred throughout much of Europe, where 'rupture' and replacement is now viewed as the order of the day (Bar-Yosef *et al.* in press). This seems to be valid even when the details are checked, as apparently most changes were incremental in nature, so that in the Levant, the whole process echoes more the trends of change observed in Africa (McBrearty and Brooks 2000). We have illustrated our point by referring to specific details of the lithic component. Yet the ramifications of what we assume to have happened at the Middle to Upper Palaeolithic interface and during the early stages of the Upper Palaeolithic bear profound implications concerning our comprehension of the pace, direction and processes of cultural evolution for early modern humans.

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7. The Palaeolithic of Turkey

Marcel Otte and Işın Yalçinkaya

Introduction

The modern territory of Turkey extends in latitude more than 2000 kilometers. In the east, it penetrates the Asian continent to the Iranian border. Its western extremity belongs to Balkan Europe, beyond the Marmara Sea. Geographically, politically and archaeologically, this immense country thus establishes the link between the three continents of the Old World, Africa included. In effect, the varied relief of the western plateaus is characterized to the east by the extension of the Rift delineating the Levantine coast. Further still, Southeast Anatolia belongs primarily to Mesopotamia, opening toward Iraq and Iran. The north, bordered by the Black Sea and the Caucasus, seems to have had limited cultural currents ; sites are rare along the Turkish Black Sea coast and are rather found along the northern coast in the Crimea, Russia and the Caucasus. The southern (Mediterranean) coast of Turkey is much richer and reflects different forms of exchange from the Levant to Europe. Despite its size and important geographic position, Palaeolithic Turkey has been the subject of only rare foreign research projects (see *e.g.* Kuhn 2002; Otte *et al.* 2005). However, this region has not been as intensively investigated as, for example, the Near East. Numerous surveys carried out by different Turkish institutions evidence the potential abundance of sites to be excavated (*e.g.* Taşkiran 2002; Taşkiran and Kartal 2004)(Figure 7.1).

The University of Liège has carried out a long-term project in southwest Turkey over the past twenty years at the cave sites of Karain and Öküzini, in collaboration with the University of Ankara, under the direction of Professor Işin Yalcınkaya and her team (Yalçınkaya 1989; Otte *et al.* 1995a; Yalçınkaya *et al.* 2002). In the late 1980s, a team from the University of Tübingen led by G. Albrecht excavated at these sites (Albrecht 1988; Albrecht *et al.* 1992), which had been previously discovered and explored during the pioneering work of Professor I. Kökten of the University of Ankara. Other teams, led by F. Clark Howell, Stephen Kuhn and Mary Stiner in collaboration with Mehmet Özdoğan and G. Arsebük of the University of Istanbul, have undertaken excavations at Yarımburgaz on the European side of the Bosphorus (Kuhn *et al.* 1996). Kuhn and Steiner have subsequently excavated in southeast Turkey, at Uçagızli, in collaboration with E. Güleş of the University of Ankara (Kuhn *et al.* 1999). The French mission at Kalatepe, directed by D. Binder, discovered Acheulian artifacts beneath the Neolithic tell (Slimak *et al.* 2004). Acheulian material is extremely abundant in the eastern part of Turkey, discovered in open-air contexts (Taşkiran 1998). The English mission at the Neolithic site of Çatal Hüyük additionally discovered numerous open-air Epi-Palaeolithic sites on the Konya Plain (Watkins 1996).

State of research

The earliest traces of human occupation were apparently discovered at Dursunlu, in central Anatolia at the bottom of a brown coal quarry (Güleç *et al.* 1999). A small series of artifacts, including irregular flakes on rough rocks and small worked cobbles, were found in association with Lower Pleistocene faunal remains, dated to around a million years ago. Sites with similar assemblages have also been found in Syria (*e.g.* Copeland 2004). The technology has no relationship to the Acheulean, already present in Israel (Ubeidiya; Tchernov 1987) and Iran (Otte *et al.* in press a). This part of Anatolia seems to belong to Euroasian traditions of this period, such as have been found at Dmanisi in Georgia (Lordkipanidze *et al.* 2000), Korolevo (Demidenko and Usik 1993) in the Ukraine and Riwat in Pakistan (Gladilin and Sitlivy 1991; Dennell *et al.* 1998; Celiberti *et al.* 2004).

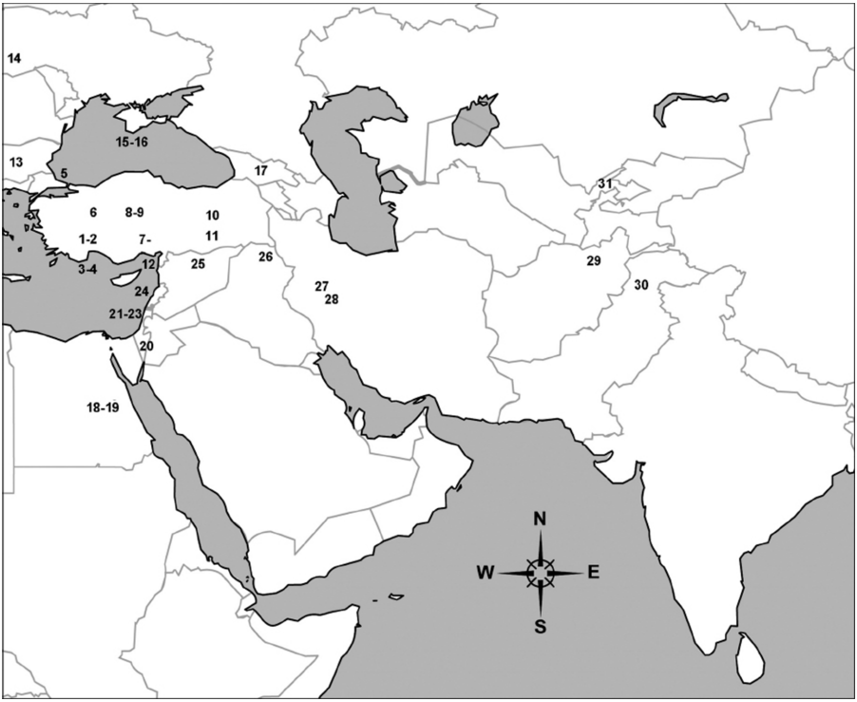


Figure 7.1. Location of sites mentioned in the text. Turkey: 1. Karain. 2. Öküzini. 3. Beldibi. 4. Belbasi. 5. Yarımburgaz. 6. Dursunlu. 7. Kaletepe Deresi 3. 8. Çatal Hüyük. 9. Pinarbasi. 10. Nevali Cori, Göbekli Tepe, Urfa. 11. Şehremuz. 12. Uçagızli. Bulgaria: 13. Mousselievo. Ukraine: 14. Korolevo. The Crimea: 15. Siuren I. 16. Buran Kaya III. Georgia: 17. Dmanisi. Egypt: 18. Nazlet Kahter 3. 19. Taramsa Hill. Israel: 20. Boker Tachit. 21. Kebara. 22. Qafzeh. 23. Hayonim. Lebanon: 24. Ksar Aqil. Syria: 25. Umm El Tlel. Iraq: 26. Shanidar. Iran: 27. Warwasi. 28. Yafteh. Afghanistan: 29. Kara Kamar. Pakistan: 30. Riwat. Uzbekistan: 31. Obi-Rakhmat.

In European Turkey, the cave of Yarımburgaz was excavated by a team from the University of Istanbul and the University of California at Berkeley (Kuhn *et al.* 1996). In addition to interesting Neolithic phases represented, a Lower Palaeolithic layer, dated to around 400,000 years ago, seems to be attached to the Eurasian tradition, with unprepared flakes and worked cobbles present in the assemblage (Figure 7.2). This would extend the European traditions present in Bulgaria to the edge of the Marmara Sea.

The situation is completely different in eastern Anatolia: the high basins of the Euphrates and its tributaries are encased in deep limestone deposits with abundant flint sources. This vast geographic area contains, for the most part, Acheulean traditions of African origin (Taşkiran 1998), as in the southern Levant (Bar-Yosef 1994) and the northern Caucasus (Lioubine 2002). However, the lack of precise stratigraphic context (apart from the depth of the geological stage) prevents dating of the sequence, apparently of long duration, if one uses the techno-typology of bifaces. A single site, Şehremuz, has yielded a well-preserved industry that was the subject of use-wear analysis on bifaces (Albrecht *et al.* 1984) (Figure 7.3).

In central Anatolia, at Kaletepe, the excavation of a Neolithic tell also yielded a perfectly preserved Acheulean industry on obsidian (Slimak *et al.* 2004) (Figure 7.3). Still being studied, it appears to correspond to the workshops present in this region where obsidian is abundant. Acheulean diffusion continues in this way toward the western part of the Anatolian plateau, but apparently becomes more limited as bifaces become rarer.

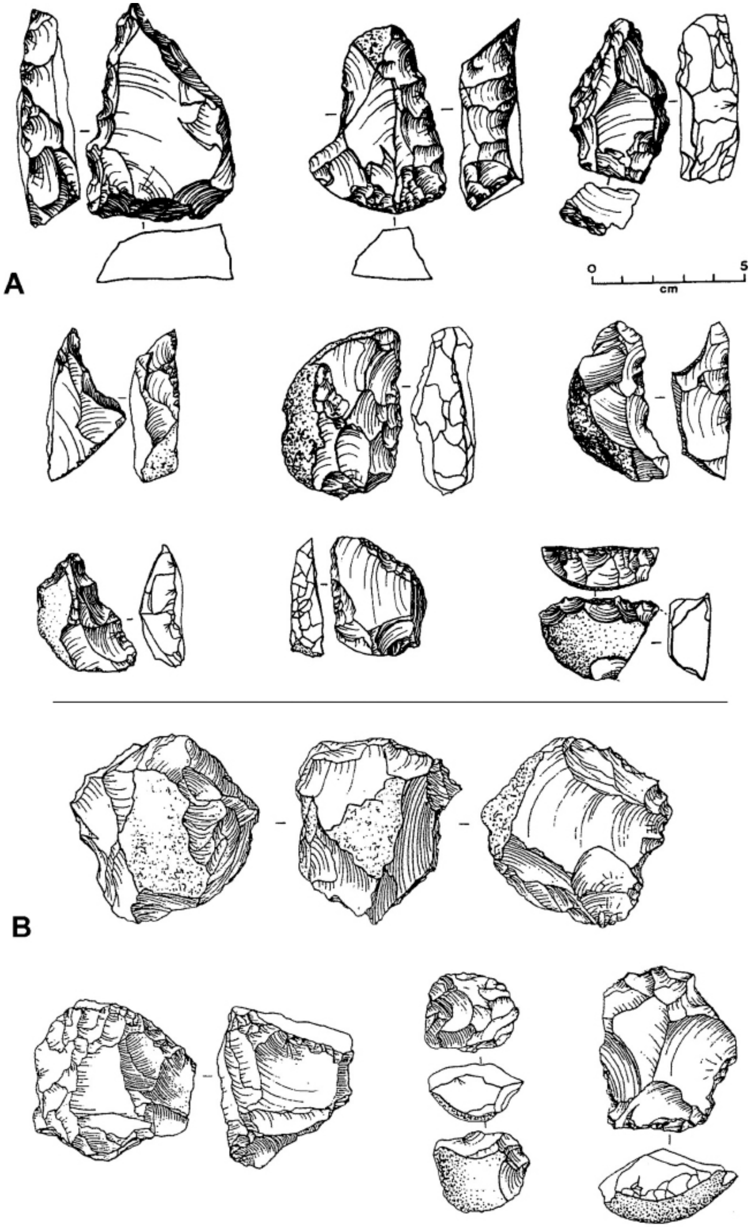
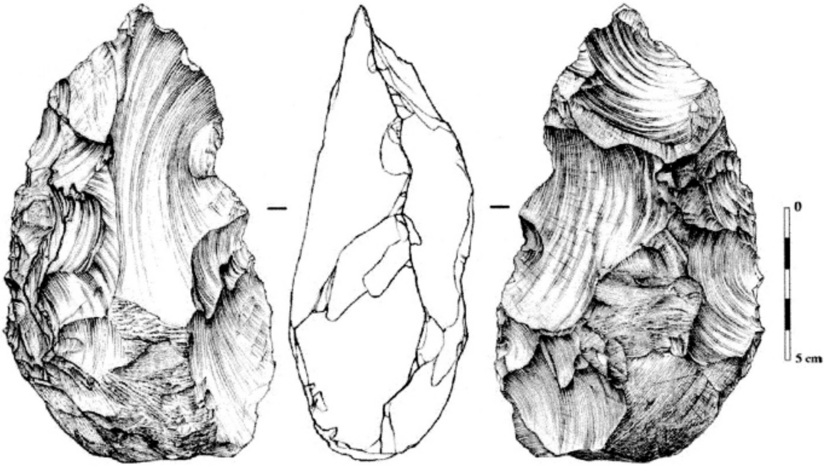


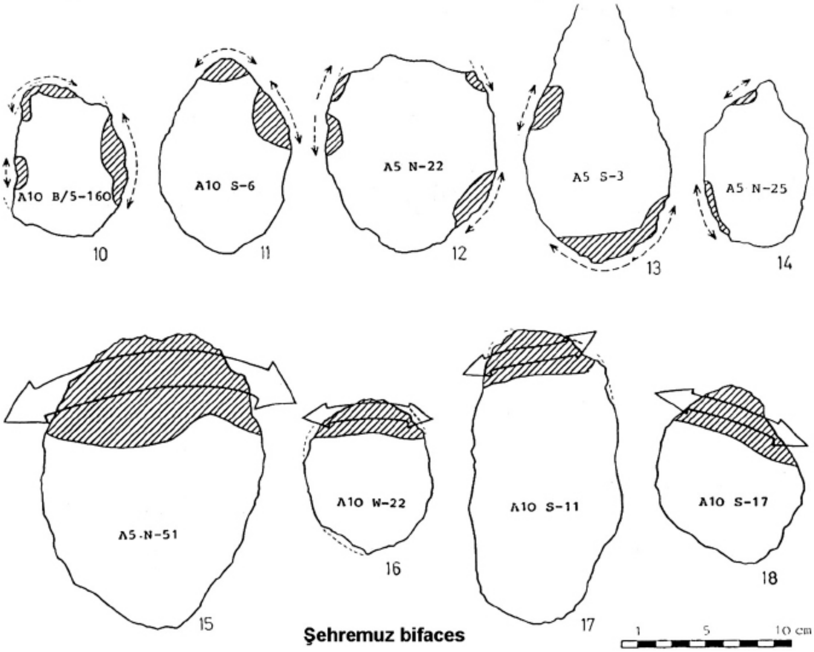
Figure 7.2. Yarımburgaz, Lower Palaeolithic. A. retouched flake tools (after Kuhn et al. 1996); B. core tools (after Kuhn et al. 1998).

After pioneering research by professor I. Kökten from Ankara, followed by excavations by I. Yalçinkaya and H.J. Müller-Beck, we have continued the study of a long stratigraphic sequence in the Karain caves near Antalya (Otte *et al.* 1998).

Chamber E has yielded the longest sequence, some ten meters thick and still being excavated. Available dates show that the middle assemblages are situated around 300,000 to 400,000 years ago, but the base remains undated. Briefly, we can state that the base has assemblages containing rough, unprepared, flakes, similar to those found at Dursunlü. The middle phase corresponds to the “European Charentian”, with irregular debitage, massive platforms, thick bulbs and tools with scalar retouch. The upper part of the sequence, representing the last 100,000 years, contains increasingly elaborate “Levallois” industries (see Figure 7.4). A few isolated Neandertal teeth were found associated with the Upper Mousterian. The sequence ends with dispersed Epi-Palaeolithic traces.


0
5 cm
KTP D3. Aval.
Niveau V

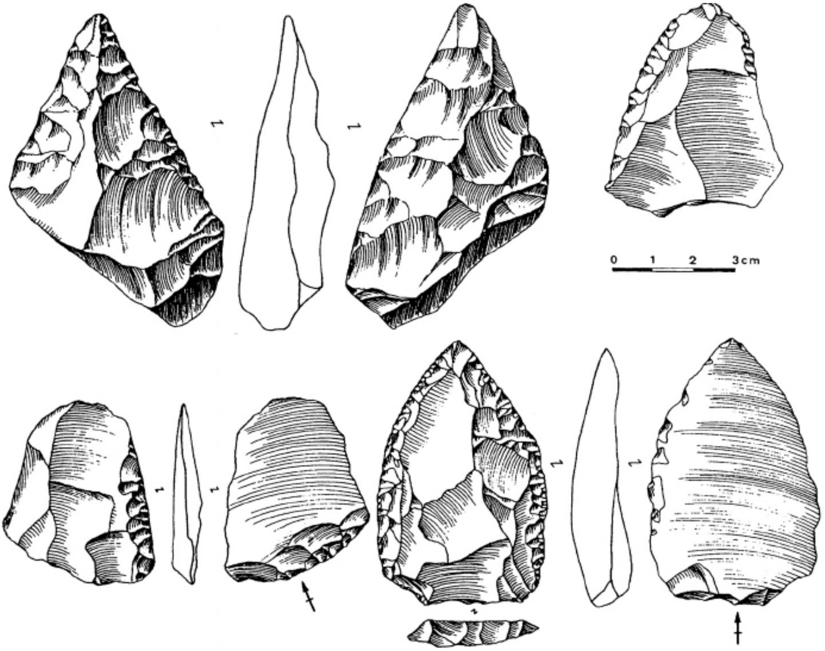
Kaletepe Deresi 3, Level V


A10 B/5-160
10
A10 S-6
11
A5 N-22
12
A5 S-3
13
A5 N-25
14
A5-N-51
15
A10 W-22
16
A10 S-11
17
A10 S-17
18
1
5
10 cm

Şehremuz bifaces

Figure 7.3. Top: Kaletepe Deresi 3. Obsidian biface from level V (after Slimak et al. 2004, 418, fig. 4). Bottom: Şehremuz, possible functional surfaces on the handaxes. 1–14: functional surfaces for shallow cutting. 15–18: functional surfaces for deep cutting. Dashed arrow: possible cutting surface for shallow cutting, working direction is given by the arrow. Outlined arrow: possible cutting surface for deep cutting functions, either along an edge or transversal cutting. (after Albrecht and Müller-Beck 1988, 80, fig. 5).

A dichotomy is observed regarding lithic raw material use: the "Charentian" is made on green or red radiolarite of local origin while Levallois methods were applied to flint of homogeneous texture. Thus, numerous workshops evidencing Levallois reduction are present near natural outcrops (*e.g.* in a radius of 100 km around Karain), from which certain elements were transported over long distances, where they appear at sites as intrusive. As during the Acheulean, the basins of the eastern rivers were also abundantly used as Middle Palaeolithic "quarries." Surface survey has shown the presence of numerous workshops characterized by utilization of methods similar to those of the Levant. The Anatolian Middle Palaeolithic thus ends with a dichotomy, perhaps partially linked to accessibility of lithic raw materials. In the mountainous arc joining the Taurus and the Zagros, the "Charentian" industries, typically on radiolarite, also contain numerous heavily retouched tools. In the central basins, assemblages of Levallois character, made on flint, evoke the Levant all the more as they sometimes include bifacial pieces, calling to mind the Yabrudian.



Karain E, arch. entity I

Karain E, arch. entity C

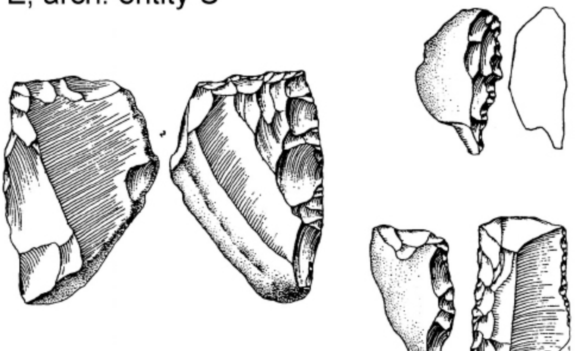


Figure 7.4. Karain E, Middle Palaeolithic. Artefacts from the "Charentian" (lower) and the "Levallois" (upper) industries (after Otte et al. 1998).

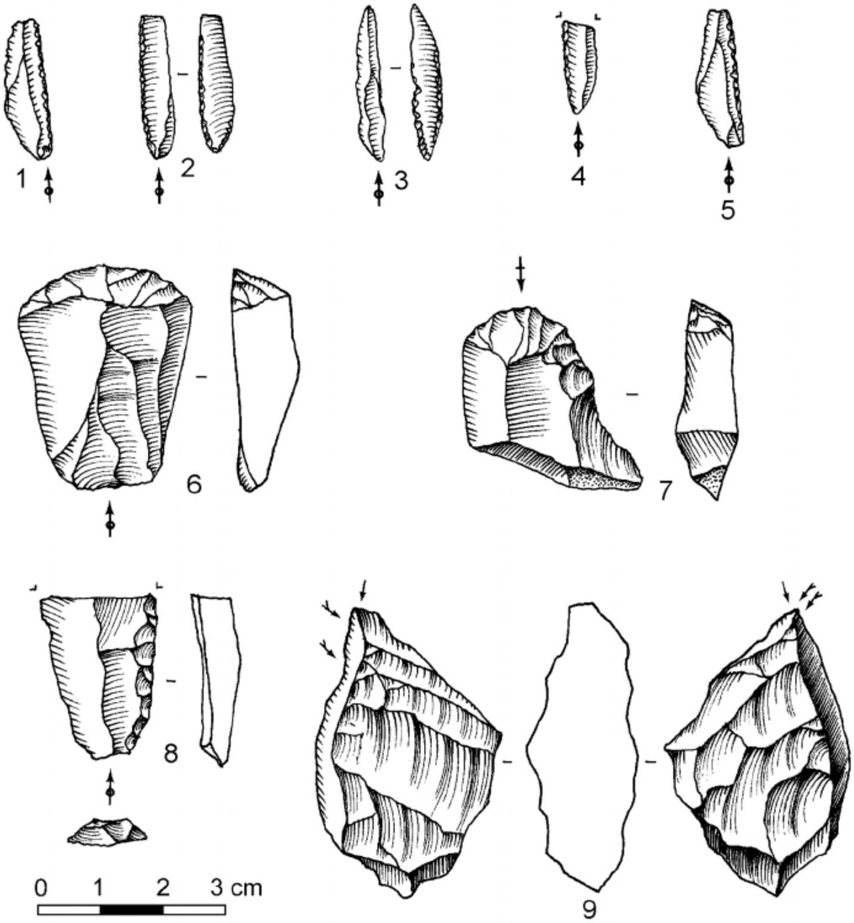


Figure 7.5. Karain B, Early Upper Palaeolithic. Artefacts from the Aurignacian industry (drawings: M. Otte). 1. P VI; 2. P IV; 3–9. P II.

At the beginning of the Upper Palaeolithic, all of these assemblages apparently disappear (as well as the populations making them?), replaced by two entirely different traditions. At the site of Karain B, the "Charentian" is replaced by the abrupt appearance of a "classic" Aurignacian, with carinated tools and finely retouched Dufour bladelets (Yalçinkaya and Otte 2000)(see Figure 7.5). If not for the absence of a bone industry, this Aurignacian would be identical to that found in Georgia and Iran (Nioradze and Otte 2000; Otte and Kozlowski 2004). It could thus correspond to a movement coming out of central Asia, related to modern humans.

The Middle to Upper Paleolithic transition in Turkey reflects the westward expansion of the Aurignacian rather than local development from the preceding Mousterian. Mousterian sites are abundant in Turkey, more common than Ahmarian sites, but have no relationship with the Early Ahmarian. Local Middle

Paleolithic technology shows a non-Levallois tendency with heavy retouch and traits similar to the Zagros Mousterian. Sites in the Hatay region contain both Levallois flakes and backed tools. By contrast, the Early Upper Paleolithic at Karain B, in southwest Turkey, is made on short blades and includes thick endscrapers and retouched bladelets in the toolkit. Sites in southeast Turkey can be attached to the Levantine tradition (Boker Tachtit in the Negev; Marks 1981) while the Aurignacian at Karain B is comparable to the Baradostian (Solecki 1958). The Zagros Mousterian appears to have led to the Aurignacian in Iran; this phase corresponds to a hiatus in Turkey. It is with the expansion of the Central Asian Aurignacian that the Aurignacian appears in Turkey.

By contrast, in the Hatay region, in the Turkish Levant, the cave of Uçagızli, formerly excavated by Kökten, and subsequently by S. Kuhn and a Turkish team, has yielded a completely different industry (Kuhn *et al.* 1999). This industry is attributed to the Early Upper Palaeolithic, dated to 39,400 and 38,900 BP for the earliest levels, predating the Ahmarian (Kuhn *et al.* 1999, 514), and contains long, regular blades, sometimes retouched into curved backed points. Dates for the Ahmarian in the Near East include new dates at 43,000 BP for Kebara (Bar-Yosef *et al.* 1996) and around 38,000 BP for the appearance of the Ahmarian at Boker Tachit A in the Negev (Marks 1981) (Figure 7.6). Uçagızli, at 39,000 BP, is thus dated between Boker Tachtit and Kebara. Two phases, the Ahmarian, beginning around 43,000 BP, and the Levantine Aurignacian, beginning around 36,000 BP, and subsequently co-existing in parallel, are recognized in the Near East (Bar-Yosef *et al.* 1996). Technological and typological criteria – the presence of Levallois and backed pieces – clearly associate the Uçagızli assemblages to the Ahmarian of the Near East (Figure 7.7), for which it would represent a recent phase and the northernmost expansion from its origin in the Negev, defined by A.E. Marks (Marks 1981). At Uçagızli, pendants have also been discovered; these are the earliest examples, which are clearly original to the Anatolian Palaeolithic.

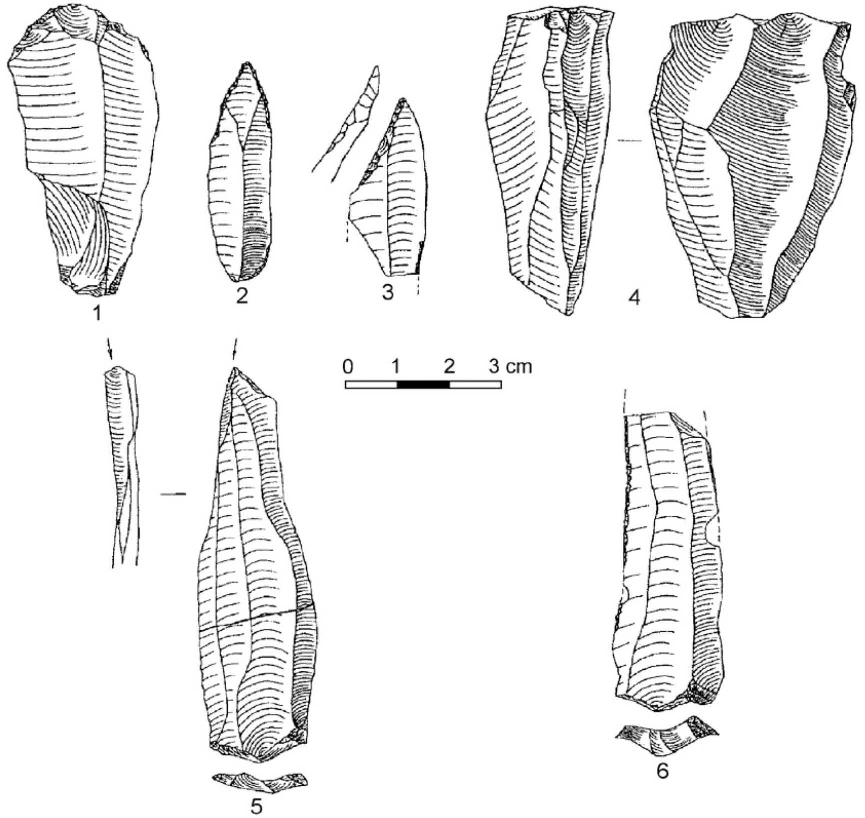


Figure 7.6. Uçagızli, Early Upper Palaeolithic. Artefacts from the Ahmarian industry (after Kuhn et al. 1999).

A new "hiatus" apparently seems to have taken place following the Early Upper Palaeolithic. To our knowledge, the late Aurignacian is not present in Turkey and the Ahmarian disappears.

The sequence resumes around 18,000 BP, present in the upper part of Karain B, more particularly at Öküzini, and finally at some plateau sites, at Tel Ilipinar or Pinarbaşi (Watkins 1996; Baird 2004, 2005). Traces of a Late Mesolithic were discovered at Beldibi and Belbaşi, near Antalya (Bostanci 1968).

The two sequences of Karain B and Öküzini are complementary and additionally geographically close (only a few kilometers between the two sites). From 18 to 16,000 BP, the assemblages contain short, retouched blades with curved back, producing points similar to "Azilian" or "Kebaran" points (Albrecht 1988; Albrecht *et al.* 1992). The toolkits increasingly tend toward bladelets segmented to make microlithic armatures, with a true developmental break in technology (Otte *et al.* 1995b)(Figure 7.9).

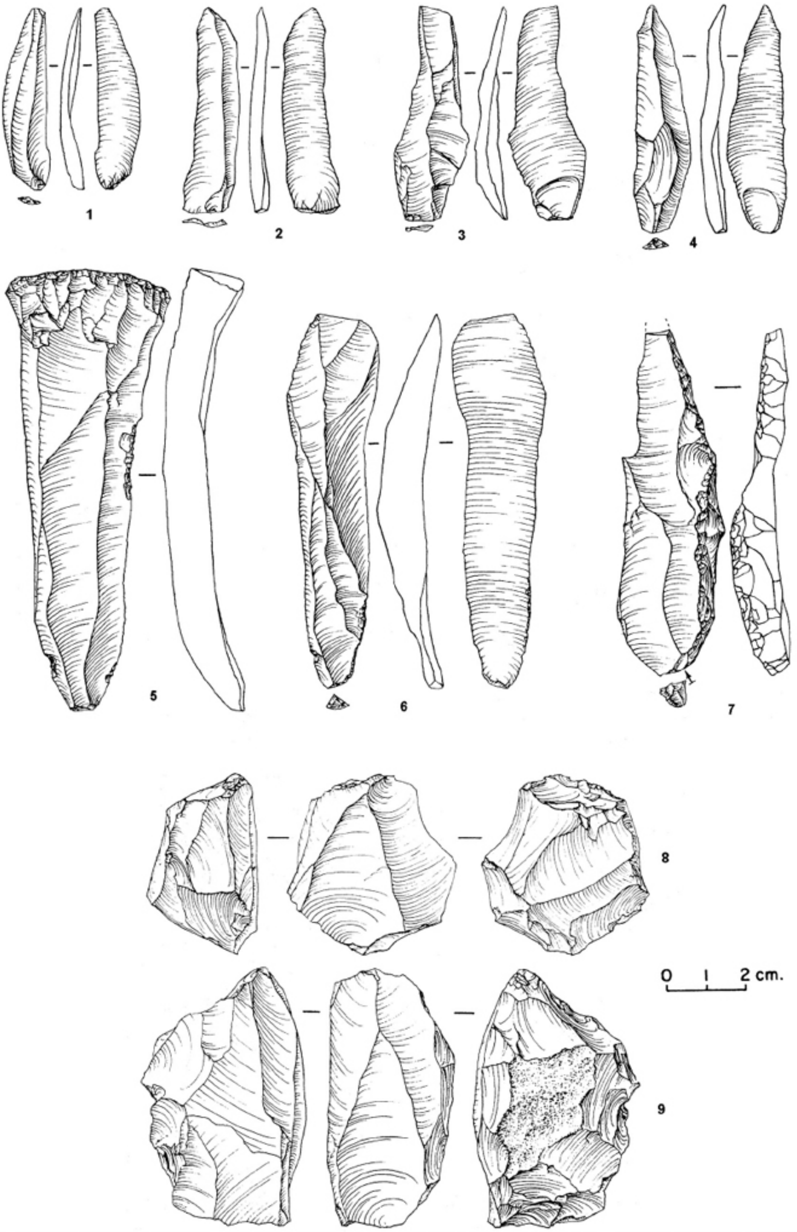


Figure 7.7. Boker Tachtit, Level 1. Ahmarian artifacts. 1–7: blades. 8–9: Levallois point cores (after Marks and Kaufman 1983, 72–73, figs. 5–1 and 5–2).

Evidence of sedentism appear (gathering of terrestrial mollusks, grinding), although the economy remains hunting-based (wild sheep and goats) until the Holocene (Yalçinkaya *et al.* 2002). If one takes into account other evidence of

"Holocene hunters", located in coastal regions, it is possible to imagine that the hunter-gatherer way of life persisted in these areas while the Neolithic became well established on the central plateaus (*e.g.* at Çatal Hüyük). If, moreover, we consider the eastern part of this vast country (Urfa, Diabakyr), we note the presence of a very early and prestigious pre-pottery Neolithic (Göbekli Tepe, Nevali Cori). Through such evidence, one thus recognizes the extreme cultural diversity represented by Anatolia, to which the prehistory of the Near East is indebted.

Turkey and the Levant

The Levantine Ahmarian seems to be the origin of assemblages of Uçagızli type in Turkey. It extends broadly to the south of the Near East. A laminar Middle Palaeolithic has very early dates, around 40,000 BP, as has been observed at Boker Tachtit in the Negev (Marks 1981). These assemblages are typical of the very beginning of the Upper Palaeolithic in the Levant (*e.g.* at Umm El Tlel in Syria). The Turkish site is, moreover, located in the geographic expansion of the Levantine region, but this culture is not found to the north or west: it had no other influence on what is now modern Turkey, and even less elsewhere. By contrast, the Ahmarian shows affinities with Northeast Africa. The Nile Basin contains numerous sites of this kind. Affinities are based on early blade debitage based on Levallois technology in Egypt and on the presence of backed pieces. Nazlet Kahter 4, for example, is an Upper Paleolithic underground chert mining site that has yielded a series of dates between 30 and 35,000 BP (Vermeersch *et al.* 2002, 267). Lithics artifacts include tools made on blades (Figure 7.8). The Taramsa burial even has a modern human skeleton associated with this culture, typically African and comparable to those in Israel (*e.g.* Qafzeh) (Vermeersch *et al.* 1998). The Turkish border thus forms the maximum extension of African influences at this period, primarily in the Levant and rarely in Turkey. During this period, the Levant was not only "modern", but – especially – African. Such modernity was not present anywhere else in the Near East.

Inversely, Aurignacian sites in Turkey have significant similarities with those of the Levant, which are entirely absent in Africa but common in Central Asia. Sites in Syria (Um El Tlell), Lebanon (Ksar Aqil) and Israel (Hayonim) contain an Aurignacian identical to that of Karain B (Antalya), but which is dated more recently, to around 32,000 BP. They have neither local roots nor southern influences: they break the continuity in the regional sequence, in all respects (presence of bladelets and bone tools). Rather than indicating a local origin of the Aurignacian, the Levantine sites reflect the southern expansion of a much vaster complex known from Afghanistan to Iraq, of which Anatolia is part. There, in Central Asia, local development is demonstrated (Warwasi and Yafteh in Iran) and links with Europe are incontestable: bone spear points, pendants, Krems points, Dufour bladelets, carinated tools. This complex was developed in place from local Mousterian industries, traces of which are evidenced within the Aurignacian.

The Levantine sites thus saw the arrival of this culture (and this population?) from a northern origin in an already evolved phase, "classic" in its development. It was superimposed on the Ahmarian, confirming both its external origin and its late arrival. Once again, Anatolia played a crucial intermediary role: it is here that we can understand the origin of movements that are elsewhere superimposed. The

Turkish Aurignacian is thus a northern source for the Near East, strongly influencing it. But in addition, this Aurignacian expanded to the west to the Balkans. Based on the dates obtained, an influence of the Levant toward the Taurus did not exist, but rather the reverse: the Aurignacian is intrusive in the Levant and continuous in Anatolia. The Ahmarian is continuous in the Levant (and in Africa) and intrusive in the Taurus.

Turkey and the Black Sea

During most of the Upper Pleistocene, the level of the Black Sea was much lower than today, such that it formed a lake closed at the Bosphorus, while the Azov Sea did not yet exist. This lake was much smaller, because the northern coast slopes gradually: the Crimea extended to the Caucasus; they are part of the same chain of mountains and caves. It is probable that many key sites are today submerged under the Black Sea along the northern coast (like Cosquer Cave in France). This is less the case along the southern coast, in contact with Anatolia, because the coasts are much more abrupt and the difference in sea level did not make a significant difference in land area exposed. In any case, terrestrial passages were made much easier between the east and west of the Black Sea by the exposure of land on both coasts.

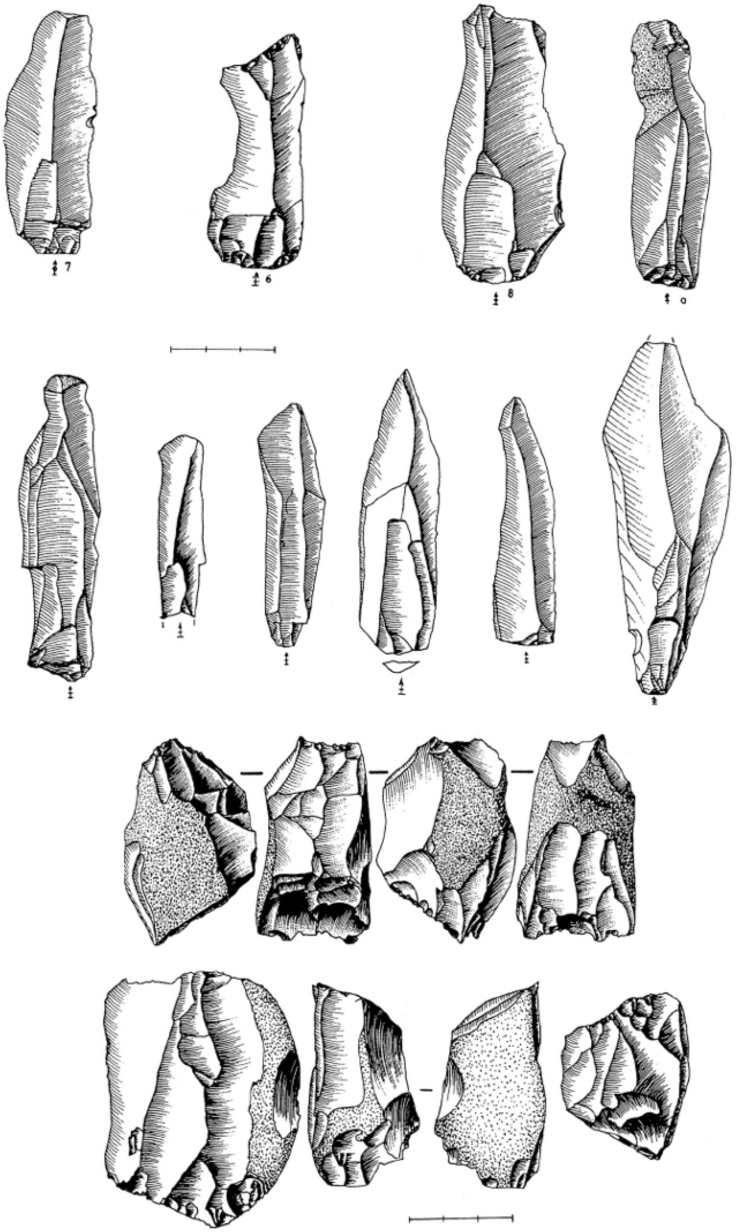


Figure 7.8. Nazlet Khater 4. Artifacts (after Vermeersch et al. 2002, 249, 251, figs. 8.50 and 8.52).

An Aurignacian identical to that of Turkey is found at Siuren I and Buran Kaya III in the Crimea, with abundant retouched bladelets, pendants and carinated tools (Demidenko and Otte 2000–2001). There is not, of course, a direct influence between them, but rather, they are cultural areas with a common origin: the Near East and Central Asia (the Middle East playing here only a minor role).

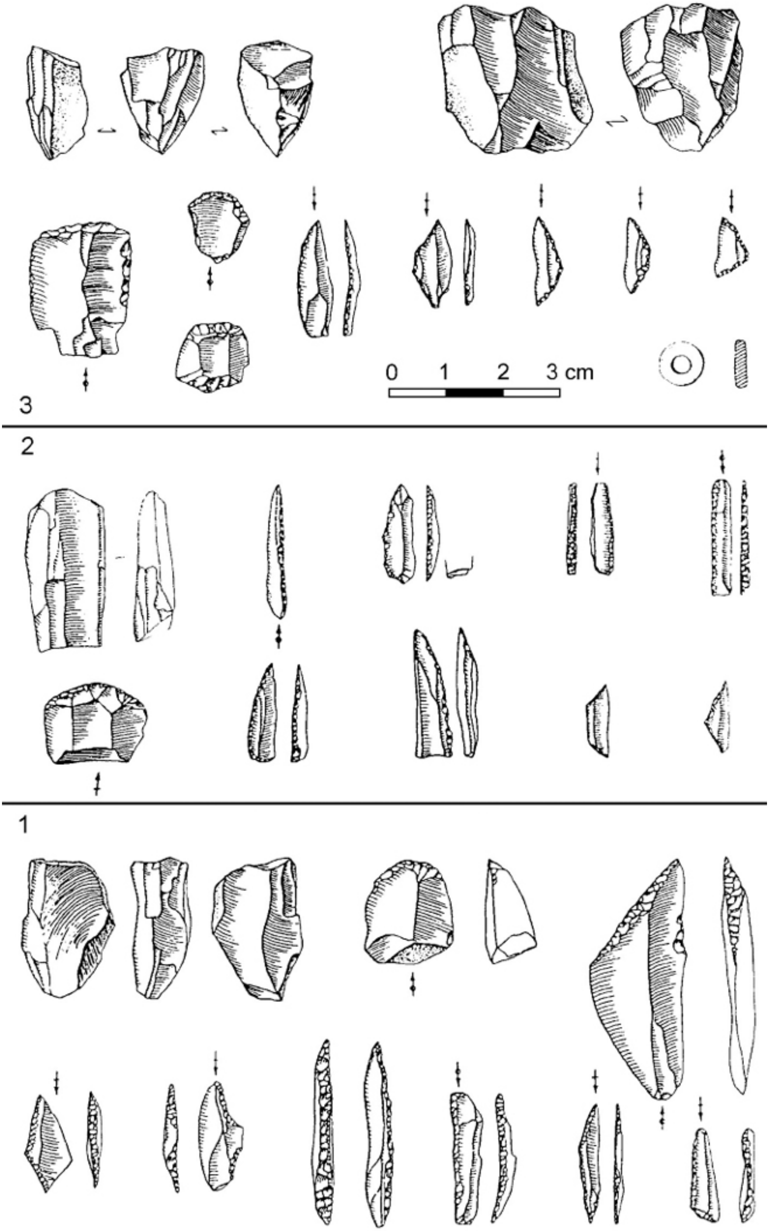


Figure 7.9. Öküzini Late Upper Palaeolithic. Artefacts from the three lithic phases (after Otte et al. 1995b).

This Aurignacian unit extends to Moldavia, Romania and Russia. The entire area north of the Black Sea belongs to this tradition, as does Karain B. However, other cultures are also known on the plains, with Mousterian affinities: the Streletskian in particular and, later, the Sungirian (Sinitsyn 2003; Flas 2006). The Turkish Aurignacian, like that north of the Black Sea, constitutes a powerful and specific cultural movement, associated with mid-latitudes that separate two other opposed cultures: the Ahmarian to the south and the Sungirian of the northern plains. Blade phenomena are, however, present, associated with Mousterian traces and rare pendants: these indices should not be used for the definition of the appearance of a culture or an evolutionary phase (although it would be tempting).

The two coasts of the Black Sea underwent a strong influence extending to the Balkans, and then to the rest of Europe, with no influence from the south but present in the Caucasus and the Zagros. The site of Buran Kaya III (study in progress) holds the key to this phenomenon, because these cultures break with the Streletskian and local Mousterian, entirely different from the overlying Aurignacian. Anatolia, like the Crimea, thus constitutes a point of contact between Asia and Europe, but along a latitudinal axis and never in longitude.

Turkey and the Balkans

The Marmara Sea has never been an obstacle to human expansion: first because the isthmuses were already exposed, then because its narrowness allows crossing at various points, even today. Historical invasion, the Neolithic expansion and innumerable contacts during the Metal Ages amply demonstrate this. The real question lies in the reason for Aurignacian movement to the west: demographic expansion, dispersal of previous Balkan populations or simple population movement from Central Asia. Regardless of the reason, the Aurignacian is clearly attested in Bulgaria as well as in Greece, and seems to have continued the traditions observed in Turkey, but without local roots: all characteristics come from elsewhere (Kozłowski 1999). Different from other "originating" regions, Bulgaria and Europe as a whole did not have Mousterian traditions that led to the Aurignacian. Rather, there are leaf-point industries (such as at Mousselievo in Bulgaria) that surely equaled Aurignacian capabilities, but which resulted from entirely different technological traditions. The best candidate for the Balkan Aurignacian thus remains Turkey, where we observe "pointed blades" added to the local Mousterian (*e.g.* at Karain E), followed by tools typical of the Aurignacian (retouched bladelets, tools shaped by bladelet removals, etc.). Between Europe and Asia, the relationship was established spontaneously in the Balkan region, arriving via the Azov Sea. The limited range in radiometric dates obtained (35,000 to 32,000 BP) shows the rapidity of movement, in fact, to the limits of radiocarbon dating. This situation remains an ongoing topic of discussion and research.

Sites in southern Greece have even supported progression by seaways, without going inland or out of view of the coast ("*cabotage*"). It is, however, certain that modern humans and the Aurignacian became established there for long periods, as evidenced by the density of occupations. Considered as a cul-de-sac, the rest of the European peninsula would have been colonized sooner or later, particularly if we consider the demographic decrease in the last Neandertals, often restricted to refuge areas and perhaps, without contact with these new populations.

Turkey and Central Asia

With the Caucasus, it is in the area of the Zagros and Afghanistan that Turkey has the strongest affinities. The most eastern site, Kara Kamar (northeast Afghanistan), dated very early (35–36,000 BP), is identical to the classic Aurignacian (Davis 2004), although it is situated within Central Asia. The Iranian plateau contains countless Aurignacian sites, as well as northern Iraq (Solecki 1955) and the Caucasus (Nioradze and Otte 2000). Following the excavations of Frank Hole (Hole and Flannery 1967), our current excavations at Yafteh Cave (Otte and Kozlowski 2004; Otte *et al.* in press b; Otte and Kozlowski in preparation) have demonstrated the antiquity and characteristics of the Aurignacian phenomenon (bone spear points, pendants, use of colorants, bladelets). Mousterian components persist until late, alongside blade and bladelet reduction. Fieldwork at this site is still in progress. The long sequence of Warwasi in Iran (excavated by Howe and Braidwood) has demonstrated the continuity between the local Mousterian and Aurignacian (Olszewski and Dibble 1994; Olszewski 1999; as well as recent study by M. Otte and J. K. Kozłowski, monograph in preparation) The extreme density of archaeological material and a very long sequence illustrate the local transition to the Aurignacian, without a single break. Parts of this sequence can also be found in different areas of the Near East (*e.g.* at Shanidar in Iraq, where there *is* a break) and, in particular, it completes and clarifies the Turkish sequence: the Mousterian base is identical to the summit at Karain E ("Zagros Mousterian"), with pointed blades. And the upper part is identical to the classical Aurignacian in Turkey (at Karain B). The interval, absent at Karain, is thus filled in by the Zagros sequence: Yafteh, Shanidar, Warwasi. It seems that the heart of this transition would be the Iranian plateau, from which innovations were rapidly transferred to the west, toward the Taurus and the Balkans.

Conclusion

Once again, Anatolia has been shown to serve not only as a natural liaison with Europe, but also as a developmental area for a capital phenomenon that brought modern humans and the Aurignacian to Europe. The great advantage of Turkey at this period is that it lacked other transitional cultures, such as the Ahmarian or the Sungirian. The Aurignacian progression is thus much clearer and more rapid (as the Acheulean was, and as the Neolithic would be). This eastern part of the Mediterranean is dominated by exchanges and cultural origins in modern Turkey. Nothing coming from the Levant could reach Europe without leaving traces in Anatolia. In fact, nothing passed along this axis during the Palaeolithic. Turkey appears as a coherent area from the Zagros to the Balkans where change occurred due to the geographic unity. Difficulties in interpretation appear outside this area, at the two extremities: toward Western Europe where other traditions persisted and toward the Levant where African influence sometimes remained preponderant (Qafzeh, Ahmarian). The Siberian region participated in other innovations (Kara Bom), where blade production emerged from local Levallois reduction techniques. The Aurignacian influence is, however, not entirely absent (Anuy, Ust-Karakol). A similar situation exists in Uzbekistan where Aurignacian sites exist as obviously. Obi-Rakhmat has the enormous advantage of demonstrating the existence of modern humans in Central Asia around 60,000 BP, outside of any African influence. These “modern” populations could have been the origin for Aurignacian cultures which, later, would spread toward Europe from Iran and across Turkey.

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8. Mediterranean southeastern Europe in the Late Middle and Early Upper Palaeolithic: modern human route to Europe or Neanderthal refugium?

Dimitra Papagianni

Abstract

Southeastern Europe, often considered as one of the likely routes of early modern human migration into Europe, is a topographically diverse area. While some parts of it may lie on a theoretical route to Europe, others, such as the coastal Mediterranean regions, may have been cut off from this route by mountainous terrain, creating potential cul-de-sacs. This paper argues that in the Late Middle and Early Upper Palaeolithic, the changes observed in the archaeological record of Mediterranean southeastern Europe (European Turkey, Greece and the eastern Adriatic) do not mirror the trajectory and timing of changes documented for inland parts of southeastern Europe. Notwithstanding the lack of good chronological control, the current record supports a late arrival (from 34,000 BP) of early modern humans in Mediterranean southeastern Europe. Unlike elsewhere in Mediterranean Europe (Spain and possibly Italy) there is no substantial evidence for a late survival of Neanderthal populations. Radiometric dates from the western coast of southeastern Europe show a hiatus of at least 10,000 years between the latest Mousterian and the earliest Aurignacian, pointing to episode(s) of extinction of Neanderthal populations prior to the appearance of early modern humans locally. This hiatus is not present on the eastern coast of southeastern Europe, where a small number of sites bridge the latest Mousterian and the earliest Aurignacian. In this part of the study region, the increase in inter-site technological variability points to localised, short-lived technological developments that may reflect sporadic population movements.

Introduction

Southeastern Europe has yielded some of the earliest well-dated skeletal remains of modern humans in Europe (Peştera cu Oase, Romania: Trinkaus *et al.* 2003) and the cultural remains commonly associated with them (Temnata Cave, Bulgaria: Ginter *et al.* 1996). These finds lend weight to the long-held view that this region was the gateway into Europe for early modern human populations, stemming from the Near East and entering Europe via European Turkey or the Black Sea region (see discussion in van Andel *et al.* 2003, 40). From there, the Danube River acted as a highway for a swift migration of the newcomers into central and western Europe (Conard and Bolus 2003; van Andel *et al.* 2003).

South and west of the course of the Danube, the mountainous terrain and broken topography that dominate southeastern Europe create potential cul-de-sacs. Such cul-de-sacs may have facilitated the local survival of some Neanderthal groups until well after the appearance of modern humans in the region, as attested by the Neanderthal fossils of Vindija Cave in Croatia (Higham *et al.* 2006). A network of mountain ranges (the Dinaric Alps, running parallel to the Adriatic Coast, and its southerly and easterly extensions, the Pindos Mountains in western Greece and the Rhodope Mountains in Bulgaria respectively), has the effect of cutting off the Mediterranean parts of southeastern Europe from the inland parts of the peninsula, leaving only one large-scale communication route to and through this region – along the Mediterranean coastline. In Mediterranean southeastern Europe – the 'Mediterranean East' section of Europe in Gamble (1986, 72) – the hinterland was largely mountainous, but the coastal areas, at parts significantly widened by lower sea levels, provided relatively productive lands and facilitated population movements. In the Late Pleistocene the high-contrast topography created a mosaic of palaeoenvironmental zones, but overall climate was milder and less continental than further inland.

This paper examines whether the archaeological record of Mediterranean southeastern Europe (European Turkey, Greece and the eastern Adriatic) in the Late Middle and Early Upper Palaeolithic (50,000–25,000 BP) reflects behavioural and demographic developments similar to those seen in inland southeastern Europe. The first two sections of the paper define the study region, describe the geographical distribution of the archaeological record and provide a summary account of Pleistocene landscapes and shorelines in the period under consideration. After that, the paper addresses the following issues: (1) can a Late Middle Palaeolithic phase be demarcated in Mediterranean southeastern Europe, and if so, what degree of technological variability can be observed in it? (2) do the excavated assemblages reported in the literature as Terminal Middle Palaeolithic, Early Upper Palaeolithic or Initial Upper Palaeolithic form an internally coherent group and do they show technological similarities with the local Late Mousterian or Aurignacian industries? (3) when do Aurignacian industries appear, how widespread are they, how uniform a group are they across the region, and do they have any local predecessors? (4) can bifacial leafpoints and surface assemblages with a mixture of Mousterian and Aurignacian elements be interpreted as 'transitional' industries and/or as evidence for acculturation of Neanderthals and early modern humans in the study region? (5) what are the continuities and discontinuities in settlement patterns between the Late Middle Palaeolithic and the Aurignacian in the study region? (6) is there any evidence for a coastal migration route along the Balkan shores, used by either early modern humans or late Neanderthals, particularly in light of recent claims for parallels between a lithic industry in southern Greece and the Uluzzian of Italy (Koumouzelis *et al.* 2001a, b)? (7) is there any evidence that southeastern Europe was a refugium for late surviving Neanderthal populations, similar to other areas of Mediterranean Europe (Spain and possibly Italy)? (8) was Mediterranean southeastern Europe by-passed by early modern humans in the early phases of their dispersal into Europe and if so what could have been the reason for this?

The study region and the geographical structure of the archaeological record

In terms of modern states, the study region comprises European Turkey, the lowland areas of Greece on either side of the Pindos Mountains and the lowland, coastal areas of Albania, Montenegro and Croatia, located on the western side of the Dinaric Alps. Research intensity across the study area is discontinuous and low over-all. Apart from certain parts of Greece and to a lesser extent coastal Croatia, in most areas the record, if there is one, consists of undated surface sites and unstratified lithic collections, while background geological or palaeoenvironmental research is lacking. By necessity, this paper relies disproportionately, though by no means exclusively, on archaeological and palaeoenvironmental evidence from Greece and coastal Croatia. (The two main sites of this period in coastal Croatia are presented in greater depth by Karavanić, this volume).

Starting at the far east of the study region (Figure 8.1) and proceeding clockwise, research in European Turkey (Runnels and Özdoğan 2001) and in the areas of Thrace (Ammerman *et al.* 1999; Fotiades *et al.* 2001) and Macedonia (Runnels 2001b) in Greece has been geographically limited and discontinuous, and the record consists almost exclusively of open-air sites. The single exception is Maara Cave (Trandalidou and Darlas 1995) in Macedonia, where a small excavation revealed what seems to be a short-term late Middle Palaeolithic occupation with limited chronological depth. Further south on the eastern side of mainland Greece, in the area of Thessaly, Theopetra Cave (Kyparissi-Apostolika 1999, 2000; Karkanas 2001) has a stratigraphic sequence spanning from the Middle Palaeolithic to the Neolithic, includes a lithic industry described as Terminal Middle Palaeolithic/'Transitional' (Panagopoulou 2000), but has no Early Upper Palaeolithic deposits. Theopetra is located at the banks of the Peneios River, the main river that runs across Thessaly, and so are most of the local open-air sites, which have yielded small surface collections of typologically Middle Palaeolithic and, in smaller frequencies, Early Upper Palaeolithic artefacts (Runnels 1988; Runnels and van Andel 1993). Further south no Middle or Early Upper Palaeolithic sites are known in the areas of Boeotia and Attica, where Palaeolithic research has been very limited.

Several excavated sheltered sites with multi-period sequences are located on the eastern side of the Peloponnese, southern Greece. In northeastern Peloponnese, Klisoura Cave contains a long Middle Palaeolithic sequence, capped by an Early Upper Palaeolithic layer and a long sequence of Aurignacian, Epigravettian and Mesolithic deposits (Koumouzelis *et al.* 2001a, b). In nearby Kephalari Cave a long, as yet undated sequence probably spans from the late Middle Palaeolithic to the Neolithic, including a small industry that may be 'transitional' Middle/Upper Palaeolithic or an artificial mixture of artefacts from both periods (Runnels 2001b). In Franchthi Cave a small number of Aurignacian artefacts were found at the bottom of a later Upper Palaeolithic, Mesolithic and Neolithic sequence (Perlès 1987). Unexcavated open-air sites in the Franchthi area have been placed in the Late Middle Palaeolithic (Pope *et al.* 1984). In southeastern Peloponnese, Lakonis Cave has a Mousterian sequence capped by an Initial Upper Palaeolithic horizon, where a Neanderthal tooth was also found (Panagopoulou *et al.* 2002-2004; Harvati *et al.* 2003), while Kalamakia Cave contains an as yet undated Middle Palaeolithic sequence (Darlas and de Lumley 1998, 1999).

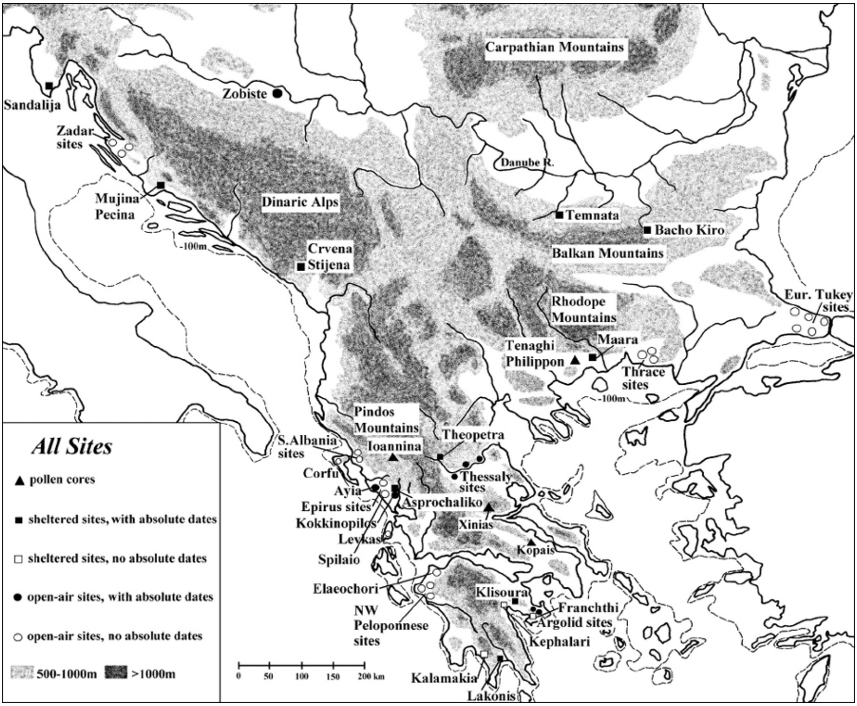
Carpathian Mountains
Sandalija
Zobiste
Zadar sites
Danube R.
Mujina Pecina
Dinaric Alps
Temnata
Bacho Kiro
-100m
Crvena Stijena
Balkan Mountains
Rhodope Mountains
Eur. Tukey sites
Maara
Tenaghi Philippon
Thrace sites
-100m
Pindos Mountains
Theopetra
S.Albania sites
Ioannina
Corfu
Thessaly sites
Ayia
Epirus sites
Asprochaliko
Kokkinopilos
Xinias
Levkas
Kopais
Spilaio
Elaeochori
Klisoura
NW Peloponnese sites
Franchthi
Argolid sites
Kephalari
Kalamakia
Lakonis
All Sites
▲ pollen cores
■ sheltered sites, with absolute dates
□ sheltered sites, no absolute dates
● open-air sites, with absolute dates
○ open-air sites, no absolute dates
500-1000m
>1000m
0 50 100 150 200 km

Figure 8.1. Map of Mediterranean southeastern Europe showing the main locations quoted in the text.

The distribution and nature of known sites on the western side of the Peloponnese (*i.e.* west of the Pindos Mountains) is markedly different: no sheltered sites, only open-air sites, all of them unexcavated, with no organic materials preserved. In northwestern Peloponnese, nearly a hundred open-air locales have been found, clustered near the coast and along river valleys (Chavaillon *et al.* 1964, 1967, 1969; Darlas 1994). They contain for the most part typologically Middle Palaeolithic material mixed with some typologically Early Upper Palaeolithic end scrapers, and some presumably post-Palaeolithic lithics. No Palaeolithic sites are known from the rest of the western Peloponnese, but this may well be due to lack of research.

Immediately to the north of the western Peloponnese, Palaeolithic research has been very limited, but further north, in northwestern Greece decades of research have generated rich Palaeolithic evidence. Asprochaliko Rockshelter contains a Middle Palaeolithic sequence capped by a sterile horizon that separates it from the next phase of occupation, in the Upper Palaeolithic (Papagianni 2000, 22–29 and references therein). The bulk of the record from this region comes from open-air sites (for example the site of Kokkinopilos), found on mainland northwestern Greece and on the islands of Corfu and Levkas, clustered near the present coast and on river valleys. TL and infrared stimulated luminescence (IRSL) dates on sediments from some of these sites place parts of their formation within the Middle Palaeolithic (Runnels and van Andel 2003). The rich surface collections from open-air sites (no stratified assemblages are available) are made up primarily of typologically Middle Palaeolithic artefacts, with small components of typologically Early and Late Upper Palaeolithic material and possibly later material too (Papagianni 2000 and references therein, Runnels and van Andel 2003). Only the surface assemblage from the site of Spilaio has been described as Aurignacian (Runnels *et al.* 2003).

Surveys in coastal south Albania have also identified open-air sites with surface assemblages showing a mixture of primarily Middle Palaeolithic artefacts with Early Upper Palaeolithic and post-Palaeolithic material (Korkuti 1983; Runnels 2001a). In Montenegro, the *c.* 20 m-thick, undated sequence of Crvena Stijena Cave spans from the Middle Palaeolithic to the Mesolithic, but probably contains no Early Upper Palaeolithic (Basler 1975; Montet-White 1996, 33-36). Excavations of the cave have recently re-opened and will hopefully clarify its stratigraphy and dating. Further north along the eastern Adriatic coast, the cave of Mujina Pećina and several open-air sites in Dalmatia all contain Middle Palaeolithic material. Mujina Pećina was most probably used for intermittent, short-term occupations between 50,000 and 40,000 BP (Rink *et al.* 2002; Miracle 2005; Karavanić this volume). The surface assemblages from the open-air sites, found both on the mainland coast and on off-shore islands, contain for the most part typologically Middle Palaeolithic artefacts (Chapman *et al.* 1996). Finally, at the far north-western edge of the study region, the sequence of Šandalja Cave II (Istria peninsula, Croatia) spans from the Aurignacian to the Epipalaeolithic and Mesolithic (Karavanić 2003, this volume).

Landscapes and shorelines

Late Pleistocene climate and landscapes

In the Late Pleistocene, Mediterranean southeastern Europe, shielded by the mountain barrier of the Alps and the Carpathians, was protected from the colder conditions that prevailed further north in Europe and had a milder climate. The topographic variability, in particular the frequent contrasts between high terrain and the sea, resulted in ‘a complex mosaic of climate zones’ (Barron *et al.* 2003, 69). Palaeoclimate simulations (Barron *et al.* 2003) show that Late Pleistocene climate in the study region varied across three gradients (1) north-to-south, (2) west-to-east, with areas in the west having higher precipitation rates, and (3) maritime-to-continental.

Long pollen records are only available from Greece. Five cores from a range of latitudes, longitudes and environmental settings reflect a similar sequence of vegetation changes across the southern Balkans, manifested as shifts between forest and open vegetation coverage (Wijmstra 1969; Wijmstra and Smit 1976; Bottema 1979; Tzedakis 1994, 1999; Tzedakis *et al.* 2004). Open, desert-steppe vegetation (grasses, chenopods and sagebrush) prevailed in phases linked to cold, dry stadials, but occasional concentrations of oak and pine trees survived in sheltered refugia. Warmer conditions favoured the expansion of deciduous and evergreen forests. In between the periods with extreme cold or warm conditions, vegetation fluctuated between continuous steppe, steppe with local tree concentrations and open woodland. Millennial-scale oscillations led to intermediate contractions and occasionally larger crashes in tree populations

(Tzedakis *et al.* 2004).

The overall trend in the 50,000-25,000 interval is a gradual reduction in tree coverage (Tzedakis *et al.* 2004, Figure 2). All pollen cores show that until *c.* 44,000 BP tree coverage was relatively high, albeit steadily declining. For the following 10,000 years arboreal pollen values fluctuated frequently but were at overall intermediate levels, until a further drop starting at *c.* 34,000 BP. The final drop, just after 25,000 BP, marks the onset of the Last Glacial Maximum (LGM).

The five pollen cores from Greece also reflect patterns of regional variation in climate and vegetation across the southern Balkans. Comparisons between the two cores from western Greece (both from Ioannina) and the three cores from eastern Greece (Tenaghi Philippon, Xinias and Kopais) (Figure 8.1) show that throughout the Late Pleistocene, vegetation in western Greece was more diverse and tree populations more abundant and more persistently present than in eastern Greece. The Pindos Mountains, which run roughly north-northwest to south-southeast, acted as an orographic barrier that wielded high precipitation levels to the areas on its west and, conversely, cast a rain-shadow to the areas on its east and south-east. In the western flank of the Pindos Mountains, the lack of extreme aridity, coupled with the diversity of the topography, allowed trees to survive throughout the Late Pleistocene in valleys sheltered from incursions of polar air. They also provided a degree of buffering of the effects of high-amplitude, high-frequency climate oscillations in OIS 3. In short, the areas west of the Pindos Mountains were the most stable ecologically in the face of climate instability. Despite the lack of long pollen records from further north in the study region, it is reasonable to postulate that the Dinaric Alps (of which the Pindos Mountains are a southern extension) would also have provided high precipitation levels and sheltered valleys and that vegetation coverage between the Adriatic Coast and the Dinaric Alps was similar to that of northwestern Greece.

The second recurrent pattern of regional variation in climate and vegetation is the increase in aridity and ecological instability in lower latitudes. Kopais, the southernmost of the five pollen sequences, shows the lowest diversity of vegetation and the lowest overall ecological stability, with the most pronounced fluctuations in tree coverage (particularly in OIS 4 and 3) (Tzedakis 1999). Palaeoclimate simulations (Pollard and Barron 2003) suggest that in the Last Glacial Maximum, mean January temperature and annual precipitation were 1 °C and 180 mm at Kopais, compared with -5.3 °C and 260 mm at Tenaghi Philippon (northeastern Greece) and -5 °C and ~655 mm at Ioannina (northwestern Greece). Aridity emerges as a key factor controlling vegetation coverage, and possibly also the intensity of hominid occupation, in the southern parts of Mediterranean Southeastern Europe.

Sea levels and shorelines

Low sea levels exposed coastal plains or coastal corridors in most parts of the study region. These well-watered and presumably productive lowlands provided routes for communication and habitats rich in resources. But throughout the Last Glacial the width and total area of these coastal lands was subject to fluctuations, as was their resource potential and their importance as communication routes (van Andel and Shackleton 1982). Reconstructing past shorelines is not straightforward, particularly in tectonically active areas like southeastern Europe. For periods earlier than the Last Glacial Maximum, larger uncertainties in the evidence allow only extrapolations on the basis of the more recent data. In the Aegean, the only area for which a detailed study is available, sea levels in OIS 4 and OIS 3 varied between *c.* -50 and -80 m (Lambeck 1996, 606, Figure 4).

With sea levels at -50 m or more, a continuous coastal zone formed along the northeastern quarter of the study region, along the modern areas of European Turkey, Thrace, Macedonia and Thessaly. Some of the Aegean islands were connected to the mainland, but most were not. On the western Balkans, a continuous narrow coastal plain ran from central Greece in the south to the northern end of the Adriatic Sea. This lowland strip incorporated the islands of Corfu and Levkas, and some of the islands that at present lie off the Adriatic Coast, and eventually formed a large lowland plain at the northern end of the Adriatic Sea. This north Adriatic plain was significantly smaller than in the Last Glacial Maximum, extending as far south as the southern end of the Istria peninsula in Croatia.

Periodisation, radiometric dates and technological variability

Dating uncertainties

In Mediterranean southeastern Europe, sites, archaeological horizons and lithic industries that broadly fall in the 50,000-25,000 BP interval are usually reported in the literature as Late Middle Palaeolithic, Terminal Middle Palaeolithic/Early Upper Palaeolithic (or otherwise ‘Transitional’), Aurignacian or Gravettian. These attributions are based on radiometric dates, where available, and analyses of the lithic industries. But most sites or individual archaeological horizons in the region are undated. They have been assigned chronological and cultural labels on the basis of geological arguments, and archaeological relative dating (on typological or technological grounds). The next sub-sections examine whether the current evidence allows for each of these four groups to be defined as a discrete chronological or cultural unit. Research at the 50,000-25,000 BP interval elsewhere in Europe has showed that these four groups or units may overlap chronologically, and that across a region their chronological limits may vary locally.

The main shortcomings of the existing evidence from Mediterranean southeastern Europe is the shortage of absolute dates and the near absence of hominid remains from excavated archaeological horizons. For example, the maps produced by the Stage 3 Project show no Mousterian or Aurignacian sites and only one Gravettian site in the study region (van Andel *et al.* 2003, Figures 4.3, 4.5, 4.7). Apart from the effects of low-intensity research, this absence of points on the map reflects the lack of absolute dates. As discussed earlier, the majority of the known sites are open-air and have rarely been dated. Some of the excavated, sheltered sites are undated, old excavations (Kephalari, Crvena Stijena), or lack materials suitable for radiometric dating (Kalamakia). In some sites, many if not all dates are unreliable (Asprochaliko, Maara, Theopetra), because they were done with methods that have now been surpassed, lack in detail of documentation in the literature or are in discrepancy with other dates from the same site. Asprochaliko Rockshelter (northwestern Greece) has a sequence of two Mousterian and one Gravettian horizons. The lower Mousterian is linked to two TL dates

(102,000 ± 14,000 BP and 96,000 ± 11,000 BP) (Huxtable *et al.* 1992). For the upper Mousterian the only available date is a C14 reading of > 39,900 BP, acquired in the mid-1960s, now largely considered unreliable (Bailey *et al.* 1992; Papagianni 2000). Another C14 date from the mid-1960s places the site's earliest Upper Palaeolithic (Gravettian) layers at 26,100 ± 900 BP (Bailey *et al.*1983). In another multi-period sequence, Theopetra Cave (eastern Greece), a series of conventional C14 dates from various Middle Palaeolithic levels spans from > 46,000BP to 33,000 BP (Kyparissi-Apostolika 1999, 2000). Panagopoulou (1999, 2000) has used these dates to anchor chronologically the lithic phases she identified in the sequence (including a Terminal Middle Palaeolithic phase). But TL dates from the lower part of the sequence suggest that the cave's sequence extends much further back in time, starting between *c.* 135,000-110,000 BP (Valladas *et al.* 2003). The documentation of the TL dates in the literature lacks the detail necessary for their evaluation, but the discrepancy with the C14 dates alludes to the strong possibility that the C14 results are minimum dates that underestimate the true age of the deposits by an unknown degree. Finally, Maara Cave (northeastern Greece) is reported to date to *c.* 50,000 BP on the basis of absolute dates, but no further information is given on the dating methods used and the readings obtained (Trandalidou and Darlas 1995).

Far more reliable are the dates from the sites of Klisoura and Lakonis (southern Greece) and Mujina Pećina and Šandalja (Croatia). The Middle Palaeolithic part of the sequence of Klisoura is as yet undated, but the Early Upper Palaeolithic layer has been dated by an AMS date at 40,010 ± 740 BP (Koumouzelis *et al.* 2001b). Other C14 dates are rejected by the excavators. The Aurignacian sequence spans several layers that date from *c.* 34,000-*c.* 24,000 BP (Koumouzelis *et al.* 2001a). The sequence of Lakonis Cave is more restricted chronologically, containing only Middle and Initial Upper Palaeolithic layers. So far only the uppermost layer of the Mousterian sequence and the Initial Upper Palaeolithic horizon have been dated. The set of three AMS dates from the upper Mousterian layer is in range and average (*c.* 42,000 BP) statistically indistinguishable from the set of two AMS dates from the Initial Upper Palaeolithic layer (Panagopoulou *et al.* 2002-2004). More dates are awaited, but for the time being this overlap indicates that there is a problem either with the dates or with the interpretation of the stratigraphy. The cave of Mujina Pećina (Croatia) contains only a Middle Palaeolithic sequence, dated between 50,000 and 40,000 BP by a series of ERS and AMS dates (Rink *et al.* 2002). Finally, a series of conventional C14 dates from the Aurignacian layers at the base of the sequence of Šandalja Cave II (north Croatia), span from *c.* 28,000-24,000 BP (Karavanić 2003).

Radiometric dates are also available from some of the open-air sites, by way of dating the geological layers with which archaeological finds are associated. None of these sites are excavated and the association of geological layers with archaeological material is based on studying exposed profiles, not excavated sequences. In northwestern Greece, TL and infrared stimulated luminescence (IRSL) dates on sediments from six open-air sites span from the Last Interglacial to the mid-Holocene (Runnels and van Andel 2003). There are only 1-2 dates available per site, so the dates do not give a sense of the length of use of each site. In Thessaly (central Greece), Runnels and van Andel (1993) have placed the assemblages from open-air sites between 45,000-30,000 BP, on the basis of C14 and U/Th readings that date the geological layers bracketing the finds-bearing deposits. And in northeastern Peloponnese open-air sites have been dated between 50,000-40,000 BP on the basis of Uranium-series dates (Pope *et al.* 1984).

The Late Middle Palaeolithic

The previous section makes it clear that chronological control over the Middle Palaeolithic of Mediterranean southeastern Europe is limited. In this context, is it possible to demarcate a Late Middle Palaeolithic phase in the region, with specific sites and lithic industries associated with it? The radiometric dates currently available cluster in two groups: (1) luminescence dates that fall in the OIS 5d-a interval, maybe reaching as far back as OIS 5e, and (2) C14 dates that fall in the OIS 3 interval, specifically 50,000-35,000 BP. The Mousterian industries in the study region can be divided into two broad technological groups: (1) Levallois industries with laminar blanks, and (2) non-Levallois, small-scale industries with non-laminar blanks. The few industries associated with dates at the OIS 5d-a interval fall into the first technological group, while the few dated industries of the second technological group fall in the Stage 3 interval. Is it then sensible to propose a two-part chrono-technological scheme of early, Levallois industries with laminar blanks, and late, non-Levallois, small-scale industries with non-laminar blanks, and therefore demarcate the latter group as Late Middle Palaeolithic? In other words, do the two technological clusters of Mousterian industries in Mediterranean southeastern Europe represent two distinct chronological groupings or two temporally overlapping or parallel technological facies? What is the degree of internal coherence of these two groupings and can the variability observed in the regional record be fully accommodated by them?

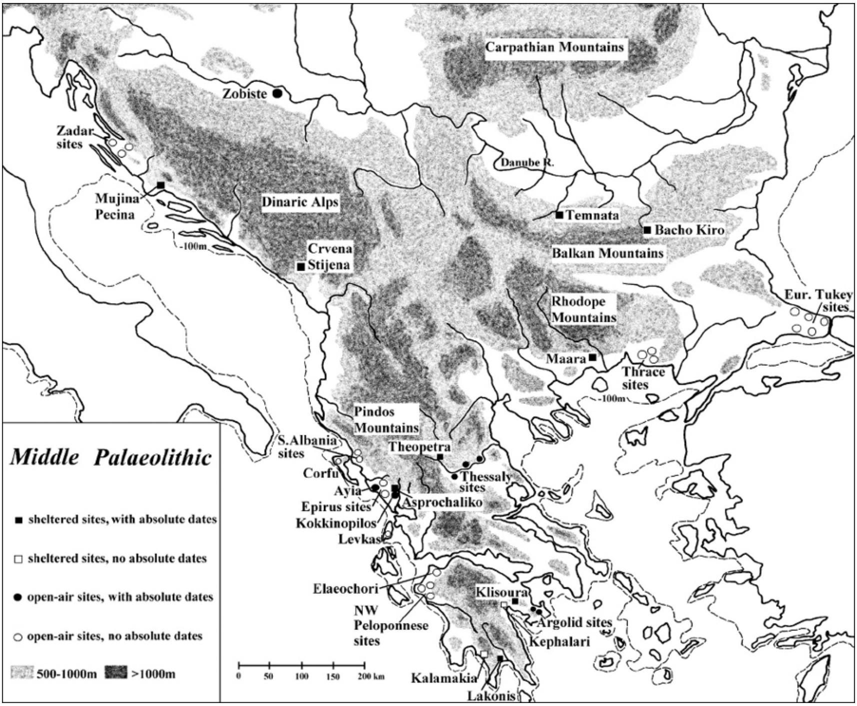
Carpathian Mountains
Zobiste
Zadar sites
Mujina Pecina
-100m
Dinaric Alps
Crvena Stijena
Danube R.
Temnata
Bacho Kiro
Balkan Mountains
Rhodope Mountains
Eur. Tukey sites
Maara
Thrace sites
-100m
Pindos Mountains
S.Albania sites
Theopetra
Corfu
Thessaly sites
Ayia
Epirus sites
Asprochaliko
Kokkinopilos
Levkas
Elaeochori
NW Peloponnese sites
Klisoura
Argolid sites
Kephalari
Kalamakia
Lakonis
Middle Palaeolithic
■ sheltered sites, with absolute dates
□ sheltered sites, no absolute dates
● open-air sites, with absolute dates
○ open-air sites, no absolute dates
500-1000m
>1000m
0
50
100
150
200 km

Figure 8.2. Map of Mediterranean southeastern Europe showing the main locations associated with the Middle Palaeolithic.

The first group consists of industries that use unipolar (and less frequently bipolar) recurrent Levallois, centripetal recurrent Levallois and discoid reduction. They were probably combined as successive stages of a single reduction sequence, with the parallel flaking being used at the early stages and the radial flaking at the final stages of a core's use-life. Laminar blanks (blades and elongated flakes) are heavily selected for reduction and the tool inventories are rich in side scrapers of various types. Industries of this group include (Figure 8.2) the Phase 2 Mousterian of Theopetra Cave in Thessaly (Panagopoulou 1999, 2000), the Mousterian of Lakonis in the Peloponnese (Panagopoulou *et al.* 2002-2004), the lower ('basal') Mousterian of Asprochaliko in northwestern Greece (Gowlett and Carter 1997), material from Kokkinopilos and other open-air sites in northwestern Greece (Papagianni 2000), south Albania (Korkuti 1983; Runnels 2001a) and the western Peloponnese (Chavaillon *et al.* 1969), and possibly the layers XXVII-XXIV of Crvena Stijena Cave in Montenegro (Kozlowski 1992). This group therefore includes all the industries associated with thermoluminescence dates at the OIS 5 interval: Asprochaliko Rockshelter (Huxtable *et al.* 1992), Kokkinopilos and other open-air sites in northwestern Greece (Runnels and van Andel 2003), and Theopetra Cave (Valladas *et al.* 2003). A very similar industry from Zobište, northern Bosnia, in the inland western Balkans, has also been dated to the OIS 5d-a interval (Baumler 1988).

Two sites with industries that technologically fall clearly into this group are associated with more recent dates: Theopetra and Lakonis. The industry of Phase 2 in Theopetra (Panagopoulou 1999, 2000) is a Levallois-Mousterian with a clear selection for laminar Levallois blanks and with a two-stage primary flaking process that starts out using unipolar recurrent methods but shifts to centripetal recurrent when the core becomes smaller. This industry is associated with conventional C14 dates that span from 46,000-40,000 BP. Being at the limit of radiocarbon dating, these are likely to be minimum dates. This is further supported by their discrepancy with TL dates from the bottom of the Mousterian sequence of the site (see section 'Dating uncertainties'). Neither the C14 nor the TL dates available allow an assessment of the true age of this industry. The Mousterian industry of Lakonis (Panagopoulou *et al.* 2002–2004) also shows a preference for the manufacture and reduction of elongated blanks. The main reduction sequences here are bipolar (or unipolar) recurrent Levallois and centripetal Levallois, both probably applied as successive parts of the same reduction sequence. With the exception of the as-yet unstudied material from the lowest stratigraphic unit, all the Middle Palaeolithic layers are grouped and discussed together as one 'technical period' (Panagopoulou *et al.* 2002-2004, 333). It is unclear whether this is because chronological changes in this material are minimal or because the issue has not yet been addressed in the analysis. The Middle Palaeolithic sequence spans from OIS 4 (an estimate on geological grounds) to the late Middle Palaeolithic. So far only the uppermost layer of the Mousterian sequence has been dated, and the dates for it (range: 45,135-38,640 BP; average *c.* 42,000 BP) are statistically indistinguishable from the dates from the overlaying Initial Upper Palaeolithic unit (see section 'Dating uncertainties').

Despite the current uncertainties regarding the chronological limits, both early and late, of the Mousterian of Lakonis Cave, it would be hard to reconcile this site with a two-part chrono-technological scheme of early, Levallois industries with laminar blanks and late, non-Levallois, small-scale industries with non-laminar blanks. The late dates from sites like Lakonis and possibly Theopetra show that at least in some parts of Mediterranean southeastern Europe these industries persisted into OIS 4 and 3 and even up to the end of the Mousterian. The assemblages of this first group also show a high degree of intra-site technological variability, which, coupled with their broad chronological resolution, indicates that further chronological, functional or other phases or facies may have existed within it but cannot be assessed.

In industries of the second technological group the Levallois is absent or nearly absent and discoid methods prevail. Elongated artefacts are absent and instead the emphasis is in the production of thick short flakes that are often selected as blanks for retouched tools. The lack of elongated artefacts has lead to industries of this group often being described as small-scale Mousterian ('Micro-Mousterian') and being linked to the Pontinian of central Italy (Rink *et al.* 2002). This group includes (Figure 8.2) the industry of Maara Cave in Macedonia (Trandalidou and Darlas 1995), the Mousterian layers of Klisoura (Koumouzelis 2001a, b) and Kephalari (Runnels 1988, 285-6) in northeastern Peloponnese, the upper layers of the Mousterian of Kalamakia Cave (Darlas and de Lumley 1998, 1999), the Upper Mousterian of Asprochaliko (Bailey *et al.* 1983), layer XIII of Crvena Stijena in Montenegro (Basler 1975), and the industries of Mujina Pećina (Rink *et al.* 2002). Surface assemblages with attributes of this group have been found in the

Bosphorous (northwestern Turkey) (Runnels and Özdoğan 2001), Thessaly (Runnels and van Andel 1993), northeastern Peloponnese (Pope *et al.* 1984), western Peloponnese (Chavaillon *et al.* 1969), northwestern Greece (Papagianni 2000), south Albania (Runnels 2001a) and the Dalmatian coast (Chapman *et al.* 1996).

All radiometric dates associated with these industries fall in the 50,000-35,000 BP interval: Maara Cave, the Upper Mousterian of Asprochaliko, Mujina Pećina, and open-air sites in Thessaly, northeastern Peloponnese, and northwestern Greece (Runnels and van Andel 2003). Of these, though, only Mujina Pećina is fairly reliably dated to after 50,000 BP (Rink *et al.* 2002) (see section 'Dating uncertainties'). Most of the rest of the industries in this second technological group can be shown on stratigraphic grounds to be relatively late (*i.e.* not earlier than OIS 4). In the few sites (Asprochaliko, Klisoura) that they are found interstratified with industries of the first group they never precede them stratigraphically. Apart from Mujina Pećina, the industries of the second group have only been dated by C14, and at least some of the dates (*e.g.* Asprochaliko) are likely to be minimum dates. Therefore, it is unclear how far back industries of the second group may date.

In most industries of this group (Klisoura, Kalamakia, Mujina Pećina) the small average implement size and the lack of elongated artefacts are attributed to the small size and relatively poor quality of the local raw materials which dominate the assemblages. But there are exceptions to this pattern. In the Upper Mousterian of Asprochaliko raw material pressure does not seem to apply. Both this industry and the earlier, Levallois industry with elongated blanks (see above) of the site, are made on local flint nodules of the same type, quality and size. On the technological front, sites with long Mousterian sequences (Asprochaliko, Klisousa, Kalamakia) show a decline in the relative abundance of Levallois debitage from the lower to the upper layers. Levallois reduction is rare or absent in all of the industries of this group. Nevertheless, in each of them a different range of non-Levallois primary flaking methods is in use. For example, Asprochaliko is characterised by an idiosyncratic primary reduction sequence for the manufacture of pseudo-Levallois points ('Asprochaliko method') (Papaconstantinou 1988; Bailey *et al.* 1992). In Klisoura the main reduction sequences identified are discoidal, non-Levallois recurrent centripetal and, rarely, Levallois recurrent centripetal. Koumouzelis *et al.* (2001b, 501) argue that a particular variation of the centripetal recurrent method in Klisoura is in fact very similar to the Asprochaliko method. In Kalamakia and Mujina Pećina primary flaking sequences are less systematic, but full analyses of the assemblages might alter this picture. The thick, short flakes that are abundant in these non-Levallois industries are often selected as blanks for retouched tools. But while in Greece the dominant tool group is lateral scrapers (*e.g.* Koumouzelis *et al.* 2001b), in the Adriatic it is notches and denticulates (Rink *et al.* 2002). This pattern holds true regardless of whether the assemblages originate from sheltered or open-air sites.

At least at times the variability seen among non-Levallois industries in Mediterranean southeastern Europe existed alongside the Levallois industries of the first group, which themselves had high levels of internal technological variability. In some sites the Levallois presence diminishes with time, in others it persists all the way to the end of the Mousterian sequences. In short, the variability observed in the record cannot be adequately described by the two-part chrono-technological scheme set out at the beginning of this sub-section, and a well-defined, technologically coherent Late Middle Palaeolithic phase cannot be demarcated in the study region. This overlapping or parallel presence of two or more technological groupings and the lack of any clear, region-wide chronological trends in technological change are not unique to this region (for a similar situation in the Mousterian of Italy see Kuhn and Bietti 2000). Kuhn and Bietti (2000, 57) speculate that 'most or all of these trends [...] are probably highly localized, representing behavioural adaptations to local conditions'.

What factors may drive this variability is unclear. Sites located in relative proximity and utilising similar faunal resources, such as Klisoura and Lakonis on the eastern side of the Peloponnese in the southern Balkans, have yielded very different lithic industries. Raw material quality and size do not determine or significantly limit technological choices. For example, the laminar Levallois industry of Lakonis and the primarily non-Levallois, non-laminar industry of Kalamakia were both made on the same local raw materials, mediocre in quality, that often shatter during percussion. The technological variability seen across time and space in the Mousterian of Mediterranean southeastern Europe also does not co-vary with whether a site was occupied sporadically or not, or with whether an industry shows high or low frequencies of retouching and resharpening. The variability seen may reflect chronological or functional facies that we do not have the resolution to assess, or localised developments that may perhaps have carried particular adaptive advantages.

The Terminal Middle Palaeolithic/Early Upper Palaeolithic

Several assemblages in the study region have been described as Terminal Middle Palaeolithic, Transitional Middle/Upper Palaeolithic, Initial Upper Palaeolithic or Early Upper Palaeolithic. The lack of agreement in terminology reflects as much the diversity among these assemblages as the divergence of analytical approaches. This group contains only three stratified, excavated industries (from Theopetra, Klisoura and Lakonis caves), all found in eastern Greece (Figure 8.3). The rest are unstratified assemblages from open-air sites, and are discussed separately (see section ''Transitional' assemblages and leafpoints: Open-air sites'). In this section I examine the degree of technological variability among these three stratified lithic industries and look at possible technological similarities with Late Mousterian or Aurignacian industries in Mediterranean southeastern Europe and neighbouring regions.

In Theopetra the lithic industry of Phase 3 is defined by Panagopoulou (2000) as Terminal Middle Palaeolithic / 'Transitional' and is placed chronologically between 40,000-33,000 BP on the basis of the associated conventional C14 dates. However, these dates lack the reliability necessary to establish that the Phase 3 industry represents the very end of the Middle Palaeolithic and possibly the transition to the Upper Palaeolithic (see section 'Dating uncertainties'). Panagopoulou describes an industry that retains the Levallois character of Phase 2 (see section 'The Late Middle Palaeolithic') but with the addition of technological and typological features that are typically linked to the Upper Palaeolithic. These features include an increase in the use of bipolar recurrent Levallois methods, a greater efficiency in the production of thin laminar blanks with parallel ridges and the introduction of a volumetric conception of the core. The retouched tool assemblage is dominated by Middle Palaeolithic types, but with the introduction in small numbers of types of the Upper Palaeolithic group (end scrapers, burins and retouched blades) and a few examples of carinated and nosed scrapers. There are no bone tools. Panagopoulou (2000, 144, my translation) sees in this sequence, not an abrupt technological change, but 'a slow, cumulative process of enrichment of the technological basis and morphological variability of the assemblages', an *in situ* 'intensification and systematisation of trends that were already present in the Middle Palaeolithic'. She points out that there is no stratigraphic break between Phases 2 and 3, and discounts on stratigraphic grounds the possibility of a post-depositional mixture of materials of Middle and Upper Palaeolithic character. This is somewhat at odds with other reports for significant mixture in the Upper Palaeolithic layers of the cave, where Middle Palaeolithic artefacts are present throughout the Upper Palaeolithic sequence, and more so in the lowest Upper Palaeolithic layers (Adam 2000). No Early Upper Palaeolithic has been identified in Theopetra. The cave was used very sporadically in the Upper Palaeolithic.

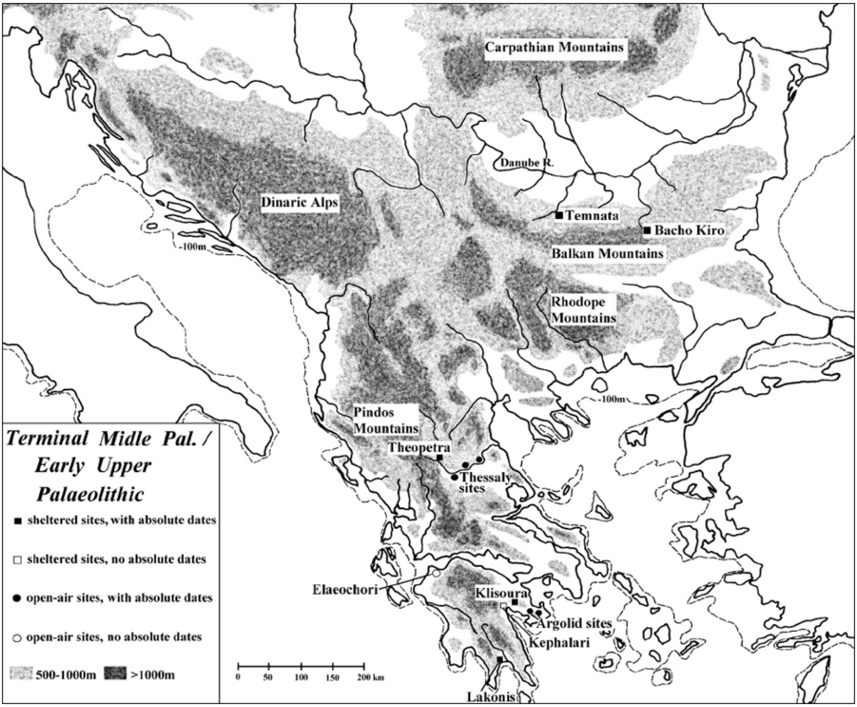
Carpathian Mountains
Danube R.
Dinaric Alps
-100m
Temnata
Bacho Kiro
Balkan Mountains
Rhodope Mountains
-100m
Pindos Mountains
Theopetra
Thessaly sites
Elaeochori
Klisoura
Argolid sites
Kephalari
Lakonis
Terminal Midle Pal. / Early Upper Palaeolithic
■ sheltered sites, with absolute dates
□ sheltered sites, no absolute dates
● open-air sites, with absolute dates
○ open-air sites, no absolute dates
500-1000m
>1000m
0
50
100
150
200 km

Figure 8.3. Map of Mediterranean southeastern Europe showing the main locations associated with the Terminal Middle Palaeolithic, Transitional Middle/Upper Palaeolithic, Initial Upper Palaeolithic or Early Upper Palaeolithic.

Panagopoulou also finds technological continuity between the Mousterian layers of Lakonis Cave in the southern Peloponnese and the industry that directly overlies them stratigraphically (Panagopoulou *et al.* 2002-2004; Harvati *et al.* 2003).

Despite the continuities, such as the use of Levallois, the latter industry is described as having a predominantly Upper Palaeolithic character and has been labelled Initial Upper Palaeolithic. In primary flaking, the bipolar recurrent Levallois that dominates in the Mousterian layers is still in use. Bladelets are made either from prismatic bladelet cores, or from Levallois laminar blanks that are turned into cores. The tool inventory retains Middle Palaeolithic elements but is dominated by retouched blades and bladelets with few other examples of characteristic Upper Palaeolithic tool types. Apart from one carinated scraper there are no typical Aurignacian tool types and no bone tools. Panagopoulou *et al.* (2002–2004, 337) state that 'no significant stratigraphic break or erosional interval was observed in the sequence' and 'post-depositional disturbance is negligible' and conclude, on technological and stratigraphic grounds, that the Initial Upper Palaeolithic industry is an 'in situ development […] from underlying Middle Palaeolithic assemblages'. The two AMS C14 dates from this layer span a large chronological interval (*c.* 47,000- 37,000BP, with 1σ error margin) and overlap with those for the upper Mousterian layer (see section 'Dating uncertainties'). More precise and stratigraphically coherent dates are needed in order to fully evaluate the significance of this industry, particularly in light of its association with a (most probably) Neanderthal molar.

An Early Upper Palaeolithic industry has also been identified in Klisoura Cave in the eastern Peloponnese (Koumouzelis *et al.* 2001a, b). It is described as an industry with arched backed blades and microliths, and with an emphasis on blade production. There are no bone artefacts, but over a dozen *Dentalium* shells were found and are interpreted as personal ornaments. This horizon is set stratigraphically between the long Mousterian and Aurignacian sequences of Klisoura and shows no technological continuities with either of them. The reduction sequences used throughout the Mousterian layers (see section 'The Late Middle Palaeolithic') are absent in the Early Upper Palaeolithic layer. In contrast to Theopetra and Lakonis, no transitional Late Mousterian industry has been identified at the top of the Mousterian sequence. Instead, the Early Upper Palaeolithic layer and the Mousterian layers are separated by a layer that contains an artificial mixture of Mousterian and Early Upper Palaeolithic material. The high frequency of blades in the Early Upper Palaeolithic industry, coupled with the selection of higher quality raw materials and the use of different primary reduction methods, also sets it apart from the Aurignacian assemblages in the cave.

Koumouzelis *et al.* (2001a, b) see the Early Upper Palaeolithic industry as reflecting an isolated episode of occupation of the site, with no links to either the Mousterian or the Aurignacian occupations. They find its closest parallels in 'the Uluzzian of the Adriatic basin and other industries with arched backed pieces of the Early Upper Palaeolithic in Europe' (Koumouzelis *et al.* 2001b, 481, my translation). They base this link on the morphology of the arched backed blades and the high relative frequency of splintered pieces (*pièces esquillées*), but acknowledge that the emphasis on blade production in Klisoura has no parallel in the reduction sequences of the Uluzzian. Based on an AMS C14 date, Koumouzelis *et al.* (2001b, 480) place the Early Upper Palaeolithic industry of Klisoura at 40,000 BP, which would make it earlier than the dated Uluzzian sites in Italy and contemporary with Late Mousterian industries in various parts of southeastern Europe and with the 'Pre-Aurignacian Bachokirian' in Bulgaria (Kozlowski 1999).

They propose that the early chronological position for the Early Upper Palaeolithic industry of Klisoura 'raises the possibility of the spread of the "Upper Palaeolithic package" independent of the Aurignacian, through the northern Mediterranean zone' (Koumouzelis *et al.* 2001a, 537) (see discussion in section 'The coastal migration route hypothesis').

At first glance these three broadly 'Transitional' industries of eastern Greece have little in common, an impression accentuated by the varied terminology used in the publications. A closer look reveals technological and typological similarities. All three industries show an emphasis on the production of blades (and bladelets), using single or double platform cores. Theopetra and Lakonis share an emphasis on the use of the bipolar recurrent Levallois, while Lakonis and Klisoura have in common the high frequency of retouched blades and microlithic elements. Apart from the occasional carinated or nosed scrapers, typical Aurignacian tool types are rare, while the toolkits are mixtures of Middle and Upper Palaeolithic types. Bone tools are absent in all three sites. In two of these sites (Theopetra, Lakonis) the 'Transitional' industries share their emphasis on blade production with the Late Middle Palaeolithic assemblages that precede them stratigraphically, although there are uncertainties in the dating of both sites. But apart from these two sites, all other Late Middle Palaeolithic industries (*i.e.* post 50,000 BP) in Mediterranean southeastern Europe are non-Levallois and non-laminar. In this sense, the emphasis on blade production differentiates these three 'transitional' industries from most of the Late Mousterian of Mediterranean southeastern Europe, as well as from the local Aurignacian (see section 'The Aurignacian').

In term of parallels further afield, Koumouzelis *et al.* (2001a, b) point to the Uluzzian as the closest parallel of the Klisoura industry. Panagopoulou *et al.* (2002–2004) place these three 'transitional' industries in a broad, mixed group of pre-Aurignacian and Initial Upper Palaeolithic industries, which date between 50,000–30,000 years ago, have elements of Upper Palaeolithic blade and bladelet technologies, and occur in the Near East and southeastern and central Europe. A close analogue to the industries of Theopetra and Lakonis is the transitional, Late Mousterian industry of Layer VI, Sector TD-II of Temnata Cave in Bulgaria (Ginter *et al.* 1996), where bipolar and unipolar recurrent Levallois methods were used for the manufacture of both flakes and blades, and the mode of reduction shows the introduction of a volumetric conception of the core. Ginter *et al.* (1996) place this industry between 50,000-40,000 BP and interpret it as the last phase in the local evolution of the Levallois technology. According to them, this process of technological evolution was interrupted by the influx of modern humans and the Bachokirian and early Aurignacian, which have no roots in the local Late Mousterian.

As a group, the 'transitional' industries of Mediterranean southeastern Europe combine a high degree of localised variability in lithic technology with a very restricted geographical distribution – confined to the central and south latitudes of eastern Greece. These areas share similar climate and resources, different from that of the colder northeastern parts or the moister western parts of the study region (see section 'Late Glacial climate and landscapes'). Similar pressures for resources may have given rise to localised developments in lithic technology. The continuities in lithic technology with the Late Middle Palaeolithic in two of the sites of this group (Theopetra and Lakonis) support this view. The central and south latitudes of eastern Greece are also fairly directly accessible from the Near East and Anatolia (taking into account the lower sea levels – see section ‘Sea levels and shorelines’), and from the northeastern Balkans. The ‘transitional’ industries, therefore, may be linked to episodes of population movements that brought with them different lithic traditions and/or developed them locally under the specific resource pressures of central and south eastern Greece. The site of Klisoura, with its technological break between the Middle Palaeolithic and the Early Upper Palaeolithic layers lends more weight to this interpretation. In any case these two alternatives scenarios are not mutually exclusive. Whether this highly localised technological variability is brought in by incoming populations or developed locally or a combination of both, these are in all cases dead-end developments, as there is no evidence for their continuation in these or other sites. It is possible that the populations that developed them died out with them.

The Aurignacian

Definite Aurignacian industries, stratified and radiometrically dated, have so far been found in only two sites in Mediterranean southeastern Europe (Figure 8.4): Klisoura Cave in the Peloponnese (Koumouzelis *et al.* 2001a, b) and Šandalja Cave II in the Istria Peninsula of Croatia, at the northwestern corner of the study region (Karavanić 2003, this volume). Neither of these two sites contains Aurignacian layers older than 40,000 BP, comparable to the earliest Aurignacian sites in inland southeastern Europe (see van Andel *et al.* 2003). The Aurignacian in Klisoura seems to start earlier (*c.* 34,000 BP) than in Šandalja (*c.* 28,000 BP), but there are no reliable dates from the lowest Aurignacian layer in Šandalja. Both sequences end at around 24,000 BP, which makes them the latest Aurignacian industries in southeastern Europe, contemporaneous with Gravettian industries elsewhere in the peninsula (see van Andel *et al.* 2003). The temporal span of Klisoura and Šandalja places them chronologically into the ‘typical (Middle) Balkan Aurignacian’ (34,000-29,000/28,000 BP; dominance of endscrapers, and presence of bone points, retouched blades, and carinated and nosed endscrapers) and the ‘Late Balkan Aurignacian’ (29,000/28,000-24,000 BP; dominance of end scrapers on thick flakes, presence of bone points, and carinated and nosed end-scrapers on chunks, and decrease or absence of blade tools) phases (*sensu* Kozlowski 1999).

In terms of predecessors and successors, in Klisoura the earliest Aurignacian directly overlies an Early Upper Palaeolithic industry with arched backed blades (see section ‘The Terminal Middle Palaeolithic/Early Upper Palaeolithic’), but shows no technological continuities with it. In Šandalja any potentially pre-Aurignacian material is limited to a few examples of typologically Middle Palaeolithic retouched tools at the lower levels of the sequence. In Klisoura there is evidence for a local transition to the Gravettian, while in Šandalja a layer that combines Aurignacian and Gravettian elements is interpreted as a post-depositional mixture rather than as a transitional industry.

The Aurignacian industries of the two sites are very similar. They show little evidence of change though time. In both sites the raw materials used were local and all stages of the knapping were carried out *in situ*. Flakes dominate at both sites. The overall frequency of blades and bladelets is lower in Klisoura, particularly in the upper layers of the sequence. Both sites have low frequencies of retouched tools, which are dominated by carinated and nosed endscrapers. In

Klisoura splintered pieces (*pièces esquillées*) are also very common, particularly towards the top of the sequence. In Šandalja splintered pieces are infrequent and burins seem to be absent. Dufour bladelets are absent from both sites, but in Šandalja this may be a result of excavation techniques. Both sites have yielded bone points and objects that were probably used as personal ornaments – perforated marine shells in Klisoura, perforated animal teeth in Šandalja. A unique feature of the Aurignacian sequence of Klisoura is a series of basin-like hearth structures, lined with clay that had been brought into the cave and specially prepared (Karkanas *et al.* 2004). Although directly comparable data are not available, artefact density seems to be significantly higher in Klisoura than in Šandalja (this may be at least partially due to differences in excavation and sieving techniques) and seems to decline towards the upper levels of both sequences.

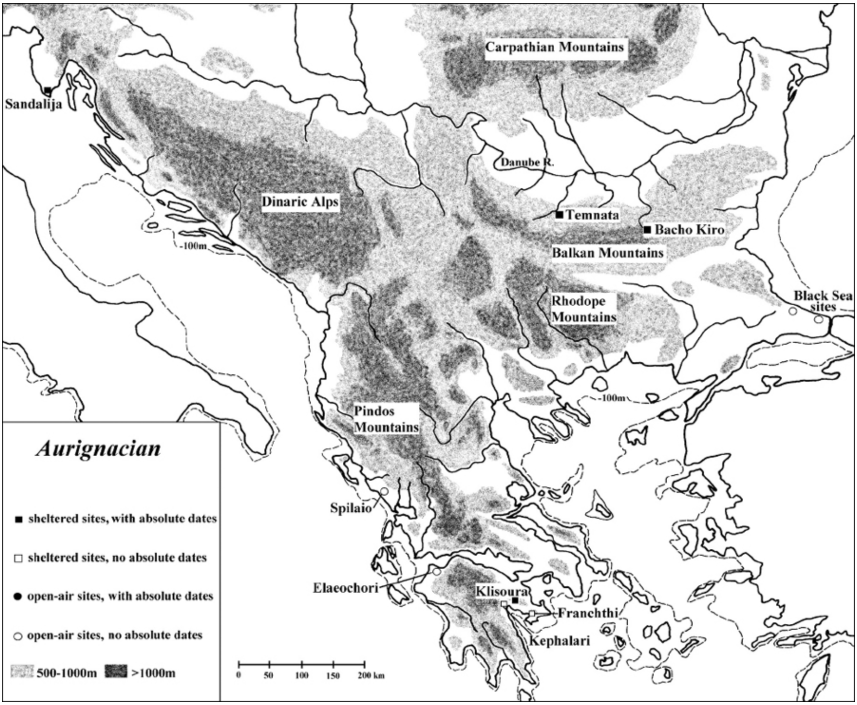
Carpathian Mountains
Sandalija
Danube R.
Dinaric Alps
Temnata
Bacho Kiro
-100m
Balkan Mountains
Rhodope Mountains
Black Sea sites
-100m
Pindos Mountains
Aurignacian
■ sheltered sites, with absolute dates
□ sheltered sites, no absolute dates
● open-air sites, with absolute dates
○ open-air sites, no absolute dates
500-1000m
>1000m
0 50 100 150 200 km
Spilaio
Elaeochori
Klisoura
Franchthi
Kephalari

Figure 8.4. Map of Mediterranean southeastern Europe showing the main locations associated with the Aurignacian.

Apart from Klisoura and Šandalja, Aurignacian industries are rare in Mediterranean southeastern Europe. Layers Xd-X in Crvena Stijena, originally assigned to the Aurignacian, are now considered to be Gravettian and Epigravettian (Mihailović 1999, 344). None of the other claims for finding Aurignacian assemblages in caves or open-air sites on the Dalmatian coast can be substantiated (Karavanić 2003). In Franchthi Cave (northeastern Peloponnese) a small number of typologically Aurignacian artefacts were found at the bottom of the Upper Palaeolithic sequence (*phase lithique I*) and were attributed to around or before 30,000 BP (Perlès 1987, 96). A poorly documented, small industry at the base of the Upper Palaeolithic sequence in Kephalari Cave in the same region (Runnels 2001b) may be a 'pure' Aurignacian or a transitional Middle/Upper Palaeolithic industry or a mixture of Aurignacian material with the underlying Late Mousterian.

In northwestern Greece the open-air site of Spilaio (Runnels *et al.* 2003), exceptionally rich in lithics, has yielded a typologically and technologically uniform assemblage that bears many similarities to the Aurignacian of Klisoura: bladelets are rare, blades are far outnumbered by flakes, and the toolkit is dominated by carinated and nosed endscrapers on retouched blades and flakes. Other tool types include flakes with marginal retouch, side scrapers, burins and splintered pieces. The reduction strategies employed were expedient and opportunistic, aiming at extracting flakes of different sizes suitable for retouch. This industry is undated but it would not be out of place in the Aurignacian of the southern Balkans and the western Adriatic (34,000-24,000 BP). In brief, Aurignacian industries are fairly uniform across Mediterranean southeastern Europe, but they are very rare and only appear *c.*10,000 years later that in inland southeastern Europe.

'Transitional' assemblages and leafpoints: Open-air sites

Several assemblages from open-air sites in the southern Balkans (Thessaly and the western Peloponnese) (Figure 8.3) contain a mixture of Middle and Upper Palaeolithic (Aurignacian) elements and occasionally small numbers of bifacial leafpoints. Runnels (1988, 277) describes such assemblages from Thessaly as 'a Levallois-Mousterian facies with bifacial leafpoints, side scrapers, Mousterian points, denticulates, and Aurignacian-type end scrapers, burins, retouched blades, and bifacial leafpoints with rounded bases'. Both groups of artefacts were made on the same raw materials. Runnels and van Andel (1993) have placed these assemblages between 45,000-30,000 BP, on the basis of C14 and U/Th readings that date the geological layers bracketing the finds-bearing deposits (see section 'Dating uncertainties'). They have argued that these mixed assemblages are evidence of contact of the Late Mousterian with the Aurignacian tradition known from the eastern Balkans (see also Runnels 2001b; Runnels and van Andel 2003, 113-115). Darlas (1994) describes a surface collection from the open-air location of Elaeochori (northwestern Peloponnese), with abundant carinated and nosed endscrapers, dihedral burins and busked burins, a low frequency of blades and none of the other Aurignacian type-fossils (*e.g.* Aurignacian blades, Dufour blades, Font-Yves points). The assemblage also contains a distinct Middle Palaeolithic component (Levallois flakes, discoid cores, high frequency of sidescrapers). Darlas regards this assemblage as an atypical, 'archaic Aurignacian' and attributes it to a late 'Transitional' phase.

The issue here is two-fold: (1) do these mixed assemblages clearly represent a single industry or cultural horizon, and if so (2) do the particular Aurignacian-like technological and typological elements indicate that these assemblages are archaic or transitional or bear witness to some form of acculturation? Perlès (2000, 381) argues that 'the association [of Middle and Upper Palaeolithic elements] is too recurrent to be attributed to systematic contaminations'. She points out that in Thessaly the findspots correspond to short-term camps and kill sites on the banks of the river and the assemblages are found *in situ*, cemented in gravel beds laid down by the river. However, it cannot be demonstrated that each findspot and its assemblage represents only a single episode of short-term use within the wide chronological interval (15,000 years) in which these sites are dated. If individual findspots are palimpsests of more than one episode of activity, potentially separated in time by several millennia, the possibility cannot be excluded that the assemblages are mixtures of elements of more than one industry, possibly the handiwork of more than one hominid species.

As for identifying transitional or archaic features, or evidence for acculturation, the absence of early Aurignacian industries (older than 34,000 BP) from the entire region of Mediterranean southeastern Europe shows that the presence of typologically Aurignacian artefacts in an assemblage does not necessarily indicate an association with the *early* Aurignacian or with the spread of anatomically modern humans into Europe. The nature of the surface assemblages in question (small numbers of artefacts, lack of stratigraphic context) does not allow much other than a selective focus on artefact groups such as carinated and nosed scrapers, burins, blades and bifacial leafpoints. The significance of the presence or absence of such elements is unclear because so little in known about either the latest Mousterian or the earliest Aurignacian from secure contexts in Mediterranean southeastern Europe. Transitional industries or technologically or typologically transitional elements cannot be identified unless it is clear what preceded and what succeeded them. When comparisons are made with industries further afield (*e.g.* the Aurignacian of the eastern Balkans or western Europe) they tend to be piecemeal, focusing on some and not the whole set of the defining features of these industries. For example, bone points, which are often essential in defining a particular Aurignacian horizon (*e.g.* the typical Balkan Aurignacian: Kozlowski 1999) are by necessity ignored since they do not survive in surface sites. This situation is not helped by the lack of agreement in the international literature over what technological and typological elements are essential for defining as industry as Aurignacian or Pre-Aurignacian or Proto-Aurignacian.

In my opinion all the assemblages from open-air sites in the southern Balkans that combine Middle and Upper Palaeolithic elements are not transitional, but rather Middle Palaeolithic assemblages contaminated by a more or less pronounced Aurignacian component. Only in the assemblage from Elaeochori the ratios are reverse: it is primarily Aurignacian, contaminated with a Middle Palaeolithic component. But this does not make it archaic Aurignacian or transitional.

Bifacial leafpoints have acquired a nearly iconic status in the literature of the southern Balkans as evidence for a transitional Middle/Upper Palaeolithic character of lithic assemblages and/or acculturation. They show a wide distribution across the region, but typically only a few of them are present per site. Found almost exclusively in open-air sites, none are known from secure contexts. Even in Theopetra Cave, the only sheltered site where they have been securely identified, they were in disturbed deposits (Panagopoulou 1999). They appear to cover a long chronological span, starting possibly as far back as OIS 5d–a, in the open-air sites of Kokkinopilos (where they are more numerous than at any other single site) and Ayia in northwestern Greece. Most locations with leafpoints, though, fall either in the Late Middle Palaeolithic group or the ‘transitional’, mixed

Middle/Upper Palaeolithic group of industries. In the open-air sites of the Argolid they have been dated to 50,000 BP (Pope *et al.* 1984) and in Thessaly to 45,000-30,000 BP (Runnels and van Andel 1993) (see section 'Dating uncertainties). In summary, in Mediterranean southeastern Europe the chronological or technological relation of bifacial leafpoints to the rest of the unstratified assemblages in which they are found is far from clear and, even if type-fossils were good markers for identifying transitional technologies and acculturation, the wide distribution of the bifacial leafpoints makes them unreliable type-fossils. Nevertheless, their presence in the study region indicates that contacts with inland parts of southeastern Europe and central Europe did exist, albeit of a nature and scale as yet unclear.

The Gravettian

The onset of the Gravettian in Mediterranean southeastern Europe postdates the earliest Gravettian in inland southeastern Europe by a few thousand years. Only two sites in the study region have Gravettian layers dated earlier than 25,000 BP: Asprochaliko in northwestern Greece and Theopetra in eastern Greece (Figure 8.1). In Asprochaliko a C14 date places the site's earliest Gravettian at 26,100 ± 900 BP (Bailey *et al.* 1983). The industry is characterised by backed bladelets (unilateral or bilateral) and microgravettes. In Theopetra an extended burnt horizon, identified in several parts of the cave, has been dated by a series of C14 dates to around 25,000 BP. The few finds associated with this horizon are a mixture of typologically Middle and Upper Palaeolithic artefacts (Adam 2000). The Gravettian becomes more widespread across the study region after 25,000 BP (Perlès 2000).

Site distribution patterns

Middle Palaeolithic sites and findspots are abundant in Mediterranean southeastern Europe and show a widespread geographical distribution (Figure 8.2). They concentrate along the coast, in lowland plains and in river valleys, and are usually found at low altitudes (commonly up to 150 m, occasionally up to 300 or 400 m above sea level). The distribution of sites shows an emphasis on the exploitation of mosaic landscapes that provided access to a mixture of habitats and the resources they supported (for similar patterns elsewhere in Europe, see Davies *et al.* 2003). Diverse land-use strategies were used. For example, in northwestern Greece and the Adriatic, sites are located either on spots that are particularly advantageous for the control of animal movements (big game hunting) or by seasonal lakes and marshes that provided access to water, raw materials and a reliable range of food resources (plants, small game, big game) (Papagianni 2008). Faunal studies are infrequent and the quality of preservation is often poor. A similar range of herbivore species has been found in most sites: deer (mostly fallow deer, but also red and roe deer), ibex, capra, equids, *Sus, Bos* and rhinoceros (Bailey *et al.* 1983; Darlas and de Lumley 1999; Panagopoulou *et al.* 2002-2004; Miracle 2005). Carnivores are either entirely absent or very rare. In Lakonis, the small assemblage of identifiable herbivores is made up of juveniles and prime adults – evidence in support of hunting (Panagopoulou *et al.* 2002–2004). A similar argument has been made for Mujina Pećina (Miracle 2005). Legumes, plants and nuts supplemented the diet: wild legumes (lentil, pea, chick-pea), wild almond, and blackberry are among the species identified in Theopetra Cave (Mangafa 2000). In most sites the lithic raw materials used are local, even when these are of mediocre or low quality. This indicates low levels of group mobility and possibly frequent re-visiting of the same locales.

Most of the sheltered sites for which relevant information is available were visited sporadically and probably only for short terms (Theopetra: Panagopoulou 1999; Karkanas 2001; Mujina Pećina: Miracle 2005), or the deposits are neither rich nor deep enough to represent a focal site (Asprochaliko: Bailey and Gamble 1990). The only exception so far is Lakonis Cave, if further post-excavation analysis confirms that its very high artefact densities are indeed due to high intensity of site use. Open-air sites, some with rich lithic assemblages, far outnumber caves and rockshelters and in many areas they seem to have been the foci of activity. They are far more numerous and more rich in well-watered areas of Mediterranean southeastern Europe (along the Adriatic and Ionian coasts) than in relatively arid areas such as the eastern Peloponnese, where Mousterian activity seems to be more focused on sheltered sites (see section 'Late Pleistocene climate and landscapes'). Many parts of these areas have been surveyed comprehensively, often by the same teams but with varying results in numbers of sites identified and artefacts collected (Runnels 2001b). These regional differences may reflect behaviour patterns (*e.g.* a high intensity of use of open-air sites in the western Balkans) or may be the outcome of local conditions of site preservation and exposure (Papagianni 2008).

The distribution of sites with potentially transitional Terminal Middle Palaeolithic/Early Upper Palaeolithic industries (Figure 8.3) coincides with the distribution of Late Middle Palaeolithic sites. That is because the three stratified examples of such industries overlay Mousterian sequences, while the open-air sites usually assigned to this group are by definition mixtures of Mousterian with Aurignacian material.

Aurignacian sites are far fewer than Mousterian sites, but they concentrate in similar topographic settings: along the coast, in lowland plains and in river valleys (Figure 8.4). This pattern is in keeping with findings across Europe: 'in terms of relief, latitude and proximity to the sea Mousterian and Aurignacian dispersal patterns seem similar' (van Andel *et al.* 2003, 49). Nevertheless Aurignacian sites are less widespread geographically: two caves (possibly as many as five, see Perlès 2000, 384) with Aurignacian evidence are located in the Argolid (southeastern Peloponnese), and three more sites are scattered along the western side of the Balkans. In the Peloponnese, the Aurignacian is found in sites that were also occupied in the Middle Palaeolithic, while in northwestern Greece and the Adriatic, two of the three known Aurignacian sites have no Mousterian occupation. As in the Mousterian, the lithic raw materials used in the Aurignacian were local, a pattern indicative of low levels of group mobility.

This analysis includes only sites with 'pure' Aurignacian industries (in one case the assemblage includes a smaller Mousterian component - Elaeochori). In addition to these sites, morphologically Aurignacian material is present in small amounts in most unstratified open-air sites where the majority of the lithic material is attributed to the Mousterian. This geographically wide but very sparse spread of morphologically Aurignacian artefacts indicates that the Aurignacian presence in Mediterranean southeastern Europe was not as restricted geographically as the distribution of the ‘pure’ Aurignacian sites allows and that the locations that attracted the bulk of Middle Palaeolithic activity continued to be used, however infrequently, in the Aurignacian. Nevertheless, with the possible exception of the Argolid, the population numbers involved must have been small. If the Aurignacian in Mediterranean southeastern Europe is placed between *c.* 35,000-25,000 BP (on the basis of the two dated sequences in the region), the decline in population densities coincides with a period of increased aridity seen in the local pollen records (see section ‘Late Pleistocene climate and landscapes’) and with the Early Cold Phase of OIS 3 (van Andel *et al.* 2003, 33).

The number of dated sites increases with the onset of the Gravettian (from 27,000 BP), but they all have very low artefact densities. Sites like Klisoura have occupation hiatuses, and surface finds are limited and discontinuously distributed. All this has led to hypotheses of near depopulation until after the end of the LGM (Perlès 2000). The first substantial change relative to the Middle Palaeolithic site distribution patterns occurs only in the Late Upper Palaeolithic (LUP), and particularly after the LGM, with the expansion of occupation to inland areas and high elevations (Bailey 1997).

The coastal migration route hypothesis

Koumouzelis *et al.* (2001a, 516) have suggested that the similarities they identify between the Early Upper Palaeolithic industry of Klisoura Cave (eastern Peloponnese) and the Uluzzian of Italy offer ‘supportive evidence for a second possible route in the spread of modern populations into Europe’, a route that follows ‘a similar trajectory to the later diffusion of Early Neolithic groups […] over the Northern Mediterranean’, starting in eastern Greece and continuing ‘along the eastern Adriatic coast to Italy and the western Mediterranean countries’. With lower sea levels the coastal areas of Mediterranean southeastern Europe would have provided a continuous route for population movements (see section ‘Sea levels and shorelines’), by-passing the mountainous hinterland. On the Italian peninsula too, the easiest migration route would have been to the east, towards the lowland plain at the north of the Adriatic (Kuhn and Bietti 2000). Even if Pleistocene geography would have made a north Mediterranean route feasible, is this scenario supported by the archaeological evidence?

The parallels between the Early Upper Palaeolithic of Klisoura and the Uluzzian amount to the presence of two artefact classes: implements with arched backs and splintered pieces (*pièces esquillées*). Despite being the ‘type-fossil’ of the Uluzzian, the backed pieces are not particularly common, except in ‘evolved’ or ‘middle’ Uluzzian industries (Kuhn and Bietti 2000, 59). Splintered pieces are common but their technological role in the Uluzzian is unclear. Overall, the technology of the Uluzzian is poorly understood and it is possible that the term ‘Uluzzian’ encompasses ‘more than one distinct type of industry’ (Kuhn and Bietti 2000, 69). The one thing that is clear about the technology of the Uluzzian is that it is not a blade industry (Milliken 1999-2000; Kuhn and Bietti 2000). This is a fundamental difference from the Early Upper Palaeolithic of Klisoura, with its emphasis on blade production (see section ‘The Terminal Middle Palaeolithic/Early Upper Palaeolithic’). Because of all these factors, the morphological similarities that have been identified between the two industries cannot be placed within a technological context. Therefore it is difficult to evaluate whether the similarities are purely circumstantial or whether they signify that these industries are part of the same techno-complex. Even if the Early Upper Palaeolithic of Klisoura and the Uluzzian are linked by a coastal migration route running along the shores of the northern Mediterranean, it is premature to assume that there is a connection with the spread of modern humans into Europe, because it is unclear whether the makers of either of these two industries were Neanderthals or modern humans.

Implements with arched backs and splintered pieces have not been reported from excavated sites along the western coast of the Balkans (*i.e.* along the route of a potential coastal migration from southern Greece to southern Italy). They appear very infrequently in surface collections in northwestern Greece (Papagianni 2000) and given the lack of a stratigraphic and chronological context it is impossible to assess whether they are at all linked with the industries discussed here.

Assuming that one route into Europe potentially taken by anatomically modern humans was via Anatolia and the Bosphorus, is there any evidence in support of population movements past the Bosphorous and down the Aegean coast of European Turkey and Greece? In a recent survey of the Bosphorus region (Runnels and Özdoğan 2001), open-air locales with Mousterian material were the most common and were found in equal measure on the Black Sea coast, the Sea of Marmara and the interior. By contrast, locales with Early Upper Palaeolithic material were found only on the Black Sea coast. Runnels and Özdoğan (2001) argue that these blade-based surface assemblages resemble the Bachokirian (Kozlowski 1999). Because the absence of bladelets and bone points – two of the critical elements that differentiate the Typical Balkan Aurignacian from the Bachokirian (*sensu* Kozlowski 1999) – from surface assemblages may be entirely due to taphonomic factors, it is hard to judge whether these assemblages are more akin to the Bachokian or the Typical Balkan Aurignacian (see discussion on such piecemeal analyses of surface assemblages in ''Transitional' assemblages and leafpoints: Open-air sites'). Therefore these assemblages may not be linked with a possible early phase of modern human dispersal into Europe. Further west along the north Aegean Coast, Palaeolithic research has been very sparse. The only relevant evidence comes from open-air findspots in southern Thrace (Ammerman *et al.* 1999; Fotiades *et al.* 2001), which have yielded a few examples of typologically Aurignacian artefacts and bifacial leafpoints among primarily Mousterian material (see section ''Transitional' assemblages and leafpoints: Open-air sites' for a discussion of the significance of such assemblages).

In summary, the archaeological evidence along the shores of Mediterranean southeastern Europe is geographically discontinuous and, in many cases, lacks the stratigraphic and technological detail that would allow anything but superficial inter-regional comparisons. The present record has also been truncated by the loss of low-lying Pleistocene coastal sites to rising sea levels. Population movements along the coasts must have occurred since this was the easiest communication route available. The evidence available, however incomplete, suggests that these movements were not large scale and were not associated with the early stages of the spread of modern humans into Europe. Unless one is prepared to argue that all the relevant evidence is on submerged coastal lands or in unexplored areas, it is difficult to support the scenario of an east-to-west coastal migration all along the shores of the northern Mediterranean.

Synthesis and discussion

Mediterranean southeastern Europe does not have a long history of research in palaeoanthropology or Palaeolithic archaeology, and despite the recent increase in excavations and surface surveys there are still inter-regional discrepancies in the intensity of research as well as major gaps in the evidence. The most important of these gaps, particularly in the context of the present discussion, are the lack of good chronological control and the paucity of hominid remains from Middle Palaeolithic and Early Upper Palaeolithic contexts (for a brief summary see Harvati *et al.* 2003).

The end of the Mousterian occupation in Mediterranean southeastern Europe is usually placed around 35,000 BP by inference to other parts of Europe, but is not well dated anywhere in the study region. In the Adriatic, the Late Mousterian sequence of Mujina Pećina ends at 40,000 BP. In southern Greece, the dates for the Late Mousterian in Lakonis Cave give an average estimate of *c.* 42,000 BP, but span the same range as the dates for the overlying Initial Upper Palaeolithic. Elsewhere, the end of Mousterian sequences has not yet been dated (Klisoura) or the dates are not reliable (Theopetra, Asprochaliko – see section 'Dating uncertainties'). There is at present no concrete evidence for Mousterian occupation in Mediterranean southeastern Europe past 40,000 BP.

Aurignacian sites are sparse, and the two dated sequences both start late (*c.* 34,000 BP or later). No Early Aurignacian has been found. The start of the Aurignacian coincides with the peak period of Aurignacian expansion in Europe (van Andel *et al.* 2003). The start of the Gravettian (27,000 BP) coincides with the first major phase of Gravettian expansion in Europe (van Andel *et al.* 2003). Therefore, there are no pioneer occupations in the Upper Palaeolithic in Mediterranean southeastern Europe.

Between the Late Mousterian and the Aurignacian, and potentially partially overlapping with both, there is a small mixed group of industries, each with a different label – Terminal Middle Palaeolithic, Initial Upper Palaeolithic, Early Upper Palaeolithic. On the basis of current dates, this group spans the *c.* 40,000-30,000 BP interval, although the dating of all the three industries has its limitations. The divergence in terminology masks the technological and typological similarities between these industries: the emphasis in blade (and bladelet) technologies, the mixture of Middle and Upper Palaeolithic tool types, the rarity of typical Aurignacian tool types, and the absence of bone tools. The emphasis on blade production differentiates these industries from most of the Late Mousterian of Mediterranean southeastern Europe and from the local Aurignacian. This group may not have exact parallels further afield, but each of the industries in it shares individual technological or typological features with both the pre-Aurignacian of the eastern Balkans (Kozlowski 1999) and the Initial Upper Palaeolithic of Anatolia (Kuhn *et al.* 1999). The 'transitional' industries of Mediterranean southeastern Europe may represent similar short-lived and geographically localised technological developments that may have sprung up independently or may be linked to population movements (*e.g.* a retreat of Neanderthals from the northeastern to the southern Balkans). The association of one of these industries with a Neanderthal tooth introduces intriguing possibilities.

Discerning the nature of the technological changes in the 50,000-25,000 BP interval is complicated by the lack of stratified sequences that contain industries of different types. Of the well-documented sites only Klisoura has a sequence of Mousterian, Early Upper Palaeolithic and Aurignacian layers, while Lakonis and Theopetra have sequences of Mousterian and Late Mousterian/Initial Upper Palaeolithic industries. The Mousterian of Mediterranean southeastern Europe is characterised by a wide range of technological variability, organised broadly around laminar Levallois and non-laminar, non-Levallois industries. The laminar Levallois tradition seems to have at least influenced some of the blade-based 'transitional'/Early Upper Palaeolithic industries. There is no such evidence for continuity for the non-laminar, non-Levallois tradition. Most of the sites where it is found are abandoned after the end of the Mousterian. The three 'transitional' industries also show a wide range of technological and typological variability. Again, most of the sites where they are found are abandoned immediately afterwards or are visited very infrequently. The Aurignacian and, later, the Gravettian appear to have no local predecessors.

Given that Aurignacian industries (and presumably modern humans too) do not appear in Mediterranean southeastern Europe before 34,000 BP, could this region have been a refugium for late Neanderthals and the Mousterian, similar to the refugia of southern Spain and possibly southern Italy? Soffer (2000) has demonstrated that late Neanderthals are found in areas with milder climates that were also refugia for tree populations. In such areas Neanderthals could continue to exploit their favourite ecological niche – mosaic landscapes that provided access to a mixture of habitats and to a variety of resources over a small geographical area. Mediterranean southeastern Europe, particularly the areas to the west of the Pindos Mountains, matches this description very closely (see section 'Late Pleistocene climate and landscapes'). The archaeological evidence, however, does not bear out this prediction. There are no sites on the western shore of the Balkans that date in the 40,000 BP – 28,000 BP interval, and the local non-Levallois, non-laminar Mousterian industries come to an abrupt end. Because of the shortage of radiometric dates and the geographically discontinuous research so far, future work may alter this picture. Nevertheless, the current evidence points to depopulation after 40,000 BP, possibly due to migration out of this region or due to localised Neanderthal extinctions prior to the arrival of modern humans.

Because of the topographic structure of Mediterranean southeastern Europe, it is likely that demographic and cultural developments in the Late Middle Palaeolithic and Early Upper Palaeolithic did not follow a uniform trajectory throughout the region. On the eastern (Aegean) side of Mediterranean southeastern Europe, three 'transitional', Late Mousterian or Early Upper Palaeolithic industries may be linked to sporadic southward migrations of small groups of Neanderthals (possibly displaced from elsewhere) or even modern humans from the eastern Balkans or from Anatolia. These migrations could have either directly introduced new traits in lithic technologies (and potential other behavioural changes that cannot be detected in the present record) or have created demographic pressures that ultimately brought about behavioural changes (for a parallel in Italy, see Kuhn and Bietti 2000).

A more substantial break with the Mousterian tradition and most probably also a population replacement occurs with the influx of the Aurignacian. The population movements involved may have been more substantial that in the previous stage, though population densities were low during the Aurignacian throughout

Mediterranean southeastern Europe.

Unlike the situation in the Iberian and (with less certainty) the Italian peninsulas, where established modern human populations in the north overlapped chronologically with Neanderthal populations in the south, there is no evidence for population overlap in Mediterranean southeastern Europe. Modern human populations were, however, well established in inland parts of southeastern Europe. It seems that the entire region of Mediterranean southeastern Europe was the equivalent of southern Iberia and southern Italy – the neighbouring area that modern humans did not colonize in the early phases of their presence in Europe. But unlike southern Iberia and southern Italy, Mediterranean southeastern Europe was sparsely occupied (at parts even completely depopulated). In this case at least, the lateness of the expansion of modern humans in this territory could not have been because an indigenous Neanderthal population 'prevented invasion' (Kuhn and Bietti 2000, 71) or due to the prospect of resource competition with the Neanderthals. Staying away from Mediterranean southeastern Europe seems to have been a deliberate choice on the side of early modern humans, a choice that to a large extent persisted throughout the Aurignacian period.

What factors could have led to such a deliberate choice on the part of an expanding population? The topographically fragmented landscapes of the study region, the differences in resources available (compared to areas further north in Europe), the discontinuous distribution of resources, the relatively high levels of aridity in parts of the region, and the shortage of easy access routes to and across the region, may have been some of the reasons that contributed to the late expansion of early modern humans into Mediterranean southeastern Europe (not until 34,000 BP) and to a generally thin occupation during the rest of the Aurignacian.

It is also possible that although generally an expanding population, at the early stages of their presence in Europe modern humans had little interest or incentive to expand into southern Europe. With the exception of one or two sites, Aurignacian sites south of the 41st parallel do not appear until 33,000 BP (van Andel *et al.* 2003), possibly as a response to deteriorating climate conditions. Even after 33,000 BP, the Aurignacian presence in southern latitudes of Europe is thinner than further north (van Andel *et al.* 2003). Although one can argue that in south Iberia and south Italy it was the presence of late Neanderthal populations that kept modern humans away, this would be at odds with the overall pattern of modern human expansion across eastern, central and western Europe, which does not seem to have been altered by Neanderthal presence. The late survival of Neanderthal populations in south Iberia and south Italy may have been an outcome rather than the cause of the lateness of modern human expansion into these areas. In this sense, modern humans stayed away from Mediterranean southeastern Europe for the same reasons that they stayed away from south Iberia and south Italy.

The difference in Mediterranean southeastern Europe is that at least in parts of this region Late Neanderthal populations had died out or migrated away, never to be replaced by other Neanderthal groups, and therefore there were no local Neanderthal population to survive late in the absence of competition with early modern humans. Such localised extinction or depopulation events must have occurred frequently in the Middle Palaeolithic, but usually the chronological resolution of the data does not allow for their identification. Another idiosyncrasy of Mediterranean southeastern Europe is that the Adriatic coastal areas, although located north of the 41st parallel, share the same fate as the south parts of the study region. This is because the Dinaric Alps cut the Adriatic coast off from the inland parts of the north Balkans and, coupled with the ameliorating effect of the Mediterranean, create a topography and climate that are more akin to those of the southern Balkans than those of the inland northern Balkans.

Post-scriptum

While this paper was in press, the publication of a set of TL dates from Theopetra Cave (Valladas *et al.* 2007) has confirmed that the previously available C14 dates vastly underestimated the true age of the site. The excavators now believe that the Middle Palaeolithic occupation of the site dates to the Last Interglacial and that the assemblages first interpreted as a 'Transitional Middle/Upper Palaeolithic' industry may be the result of post-depositional mixing of cultural material. These results are in agreement with the reservations expressed in this paper regarding the validity of the C14 dates from Theopetra and the stratigraphic integrity of the 'Transitional' industry.

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9. The Early Upper Palaeolithic in Romania: past and current research

Ildiko Horvath

Abstract

Romania has yielded a rich record of archaeological and palaeoanthropological finds that date to the late Middle Palaeolithic and early Upper Palaeolithic. The available dates suggest that the Upper Palaeolithic did not appear particularly early in Romania, although in parts of the country, some earlier behavioural changes already emerged during the Mousterian. The Upper Palaeolithic brought in new technologies and behaviours, but these did not suddenly replace earlier tool-making traditions and adaptations. The infiltration of Aurignacian technologies is generally associated with more marked changes and these technologies are documented at sites where Mousterian elements are missing. Most early Upper Palaeolithic assemblages are, however, devoid of Aurignacian characteristics and, at these sites, a greater degree of continuity is evident between the Middle and the Upper Palaeolithic. Given the complexity of the archaeological record, a single evolutionary model cannot be applied to the Romanian early Upper Palaeolithic; both external change and local developments played a role in the crystallization of new technologies and behaviours.

The paper aims to create a regional synthesis of the Middle to Upper Palaeolithic transition in Romania by bringing new and old research directions, results and methodologies together. The paper also builds on the author's research in northeastern Romania and findings on lithic technology are included in the discussion. As the Romanian early Upper Palaeolithic archaeology relies heavily on excavations, discoveries and interpretations made decades ago, research results are discussed in reference to the specific historical context. Aurignacian and non-Aurignacian early Upper Palaeolithic industries are presented mostly from a typological perspective. The discussion broadens in scope when the paper elaborates upon the behavioural changes that took place during the late Middle Palaeolithic and early Upper Palaeolithic; information is presented relative to lithic technology, site and resource use, subsistence, adaptation and symbolic behaviour. The paper concludes with a summary of late Middle and early Upper Palaeolithic hominid findings in Romania.

Introduction

Known for its poorly reported and un-systematically dated archaeological finds, as well as its traditionally more reclusive archaeological community, Romania received very little coverage in the archaeological literature that was accessible to North American and Western European archaeologists. With few exceptions (Allsworth-Jones 1986; Honea 1986b, 1993; Kozlowski 1988; Păunescu 1988;

Cârciumaru 1989; Otte and Chirica 1993; Cârciumaru and Ulrix-Closset 1995; Otte *et al.* 1996a; Mertens 1996; Cârciumaru 1999), very little information came out of this country and western participation in archaeological fieldwork and research remained equally limited. Romania was perceived as a peripheral area that had very little to add to the debate on the Middle to Upper Palaeolithic transition than so actively engaged archaeologists in neighboring countries and regions. This perception has dramatically changed with the discovery, but most importantly, the prompt assessment, dating and publication of the Peştera cu Oase hominid remains in 2002 and following years (Trinkaus *et al.* 2003a, 2003b). The earliest directly dated modern humans in Europe have not only proven that Romania has an important and potentially rich palaeoanthropological record dating back to the early Upper Palaeolithic, but they have also opened a suite of new and complex questions concerning the evolution of human culture during the early stages of the Upper Palaeolithic, in a country where the Upper Palaeolithic did not appear particularly early, yet Mousterian technologies persisted for a long time.

While the Peştera cu Oase discovery has played an important role in shifting international attention to Romania and will act as a catalyst for future archaeological and palaeanthropological research, the study of late Middle and early Upper Palaeolithic industries has a long history in Romanian archaeology. Early archaeological excavations and discoveries at the end of the 19th century and beginning of the 20th century at important open-air sites, such as Ripiceni-Izvor, Mitoc, Szitabodza and Iosăşel, as well as cave sites in the Southern Carpathians brought to light a particularly rich and complex record of human remains and cultural activity dating back to the Middle and the early Upper Palaeolithic. By the early 1940s, the acute attention directed towards the local Palaeolithic past made the late Mousterian and early Upper Palaeolithic well known to the Romanian archaeological community (Roska 1912, 1923, 1924, 1925a, 1925b, 1926, 1927a, 1927b, 1928, 1929a, 1929b, 1931a, 1931b, 1933, 1942, 1943, 1956; von Gaál 1928, 1943; Mallász 1934; Moroşan 1936, 1938; Nicolăescu-Plopşor 1938; Balogh 1942; Rainer and Simionescu 1942; Simionescu 1942) and appreciated by scholars elsewhere (Götzinger 1919; Breuil 1925). While the geopolitical changes that followed the Second World War brought Palaeolithic archaeology to a halt in Transylvania, research continued in the eastern and southern regions of the country, leading to a steady increase in the number of known archaeological sites that date to the late Middle and the early Upper Palaeolithic. This stage of research led to the emergence of two new regions of interest with a heavy concentration of archaeological sites, the Southern Carpathians and the middle section of the Prut River in northeastern Romania. In this latter region alone, in an area that is less then 10,000 square km, archaeologists discovered and excavated 19 Mousterian and early Upper Palaeolithic sites, and an additional 25 have been surveyed and reported to date to this time period (Păunescu 1999a).

While the number of known archaeological sites in Romania is impressive even in comparison to better researched regions of Palaeolithic Europe, the amount of information that pertains to these sites is more limited, due, primarily, to fewer systematic excavations, very summarily executed material analyses, limited dating and insufficient publicaton. Only twelve of the northeastern Romanian Palaeolithic sites have been excavated to some extent, and chronometric dates have been obtained for only two, Mitoc-Malu Galben and Ripiceni-Izvor (results are expected on a third site, Mitoc-Valea Izvorului). The available evidence from these late Middle Palaeolithic and early Upper Palaeolithic sites points, however, to an impressive behavioral complexity, some of which predates the arrival of anatomically modern humans. This is attested to by the appearance of large mammoth bone features in the Mousterian layers at Ripiceni-Izvor (Păunescu 1993, 1999a), the presence of bone artifacts at various locations and extensive ochre use at Mousterian sites in the Southern Carpathians (Cârciumaru 1999). Romanian archaeologists have long emphasized the importance of these findings and supported the idea that the Carpathians and adjacent areas had an important role to play in the evolution of human culture and behaviour in Palaeolithic Europe (Bitiri 1965a; Bitiri and Cârciumaru 1981; Chirica 1987, 1988, 1995; Păunescu 1988; Borziac 1994; Chirica *et al.* 1996a).

This paper brings together past research results and new directions in the study of the Middle to Upper Palaeolithic transition in Romania. In building a regional summary for the region, particular emphasis will be placed on addressing the intellectual, political and historical context of scholarly research in this country and the understanding of some of the limitations and leading intellectual biases that have shaped the process of archaeological research. Building on the author's current research in northeastern Romania (Horvath 2003, 2004), the paper will refer to new directions and results of research, primarily in the field of technological studies that will hopefully lead to a more comprehensive understanding of the behavioural changes that preceded and guided the Middle to Upper Palaeolithic transition in this country. Following a brief survey of the research directions and parameters in the study of the Romanian early Upper Palaeolithic, the paper will present the chronological context of the Middle to Upper Palaeolithic transition in this country and explore archaeological industries that developed during this time interval. The following section will look beyond lithic typology to understand the evolution of human behaviour, in general, during the Middle to Upper Palaeolithic transition. This discussion explores changes and continuing traditions in the domain of lithic typology, site distribution, the organization of living space, the use of lithic and organic raw materials, resource procurement and symbolic behaviour. An overview of the Middle and early Upper Palaeolithic hominid record completes the regional summary on the Romanian transitional period.

Early Upper Palaeolithic research in Romania

Older and more recent archaeological excavations in Romania yielded a large number of sites that date to the transition from the Middle to the Upper Palaeolithic, but the assessment of these sites is hampered by methodological biases that have defined field research and data analysis in this country. The most salient obstacle in creating a regional synthesis on the Romanian early Upper Palaeolithic is the poor understanding of its chronological context. Having relied on foreign scholarly assistance to date Palaeolithic sites, dating in Romania is limited to a handful of sites that either involved direct participation in excavation by foreign archaeologists, or subsequently attracted the attention of specialists from outside (Honea 1984, 1986a, 1986b, 1987, 1993, 1994; Damblon *et al.* 1996; Otte *et al.* 1996a; Alexandrescu *et al.* 2004; Noiret 2004). The great majority of the sites that are known to contain transitional or early Upper Palaeolithic material were excavated decades ago, and most are still un-dated. The few archaeological sites that have chronometric dates, rely almost exclusively on dates obtained by the traditional radiocarbon method. This method not only has real technical limitations for dating Middle Palaeolithic material, but, even when used within the optimal time frame, it has been shown to produce dates that are too young. Wider application of the TL dating method at Palaeolithic sites across Europe has revealed that the latter consistently yields dates that are older and more accurate than those derived with the traditional radiocarbon method (Gladilin and Demidenko 1990; Mellars 1999; Zilhão and d'Errico 1999; Richter *et al.* 2000). Similar problems emerged in Romania, at sites where alternative dating techniques were employed. At the Aurignacian site of Giurgiu-Malu Roşu, radiocarbon dates were found to be younger (21,140 ± 120 and 22,790 ± 30 BP) than those obtained by optical luminescence (27,000 ± 3,000 BP) (Alexandrescu *et al.* 2004).

Uneven geographic coverage and the under-representation of some regions have also had a significant bearing on the reconstruction of the Middle to Upper Palaeolithic transition. Administratively and intellectually, Romania has been a country with a strong regional segregation. Central institutes that have governed archaeological research in distinct regions of the country have had a nearly exclusive leadership in the planning and execution of archaeological projects, leaving very little room for inter-regional contacts and overlap of research areas and scholarly endeavors. In the south and northeast, the leading archaeological centers, the Institute of Archaeology at Bucharest and Iasi, respectively, have become particularly active after the 1950s, precipitating Palaeolithic research in the Southern Carpathians and the Southern Romanian Plain, as well as in the Eastern Carpathians and the Moldavian Plain. It is largely a result of these specific circumstances that the heaviest concentration of archaeological sites and best known late Mousterian and early Upper Palaeolithic sites come from the very same regions, the Southern Carpathians, the Southern Romanian Plain, the Bistriţa River Valley in the Eastern Carpathians, and the middle Prut River Valley in the northeast. These parts of the country have provided us with the highest concentration of hominid sites (in the Southern Carpathians), the longest documented sequence of Mousterian and Upper Palaeolithic occupation (Ripiceni-Izvor), the oldest firm evidence for Aurignacian in Romania (Mitoc-Malu Galben), and the youngest attestation of the Aurignacian in this part of the continent (Giurgiu-Malu Roşu) (Figure 9.1). The concentration of these major archaeological findings in those areas is, however, an artifact of more intense research involving those regions.

Other regions, particularly Transylvania, have remained seriously under-represented in Romanian Palaeolithic archaeology, due to a lack of local leadership that could promote and oversee research in this field. Ironically, this was the region that in the early decades of the 20th century reported the largest number and most spectacular archaeological and hominid discoveries. Unfortunately, following the political and social changes that took place after the Second World War, Transylvania was left without palaeolithicians who could carry on the research started by the pioneers of Romanian Palaeolithic archaeology. This part of the country not only remained without leadership and initiative in Palaeolithic research, but also with a legacy of findings and accomplishments that was promising but scanty. All archaeological sites that are known today in Transylvania have been unsystematically excavated and discoveries summarily reported (Roska 1924, 1925a, 1927b, 1928, 1929a, 1931a, 1933, 1942, 1956; Kadić 1934; Mallász 1934). This state of research has led to a poor understanding of some very important issues that pertain to the Palaeolithic of this region, primarily the archaeological context of hominid findings (most known hominid sites are located in Transylvania), the development of the Aurignacian in this part of the Carpathian Basin (two potential key sites, Szitabodza and Igriţa were located, but only summarily excavated) or the infiltration of Szeletian influences from Central Europe (Iosăşel, a very poorly explored site located in Transylvania may be the richest Szeletian site in Romania). To some extent, language and ethnic barriers have also played a role in the isolation of this region from research that has precipitated in the rest of the country. The pioneers of Palaeolithic archaeology in Transylvania were ethnic Hungarians, and most of the initial reporting was done in Hungarian. Although a comprehensive summary of the early research was published in Romanian (Jungbert 1978–1986), few archaeologists who have worked outside the region have had the language competency to access the original reports directly.

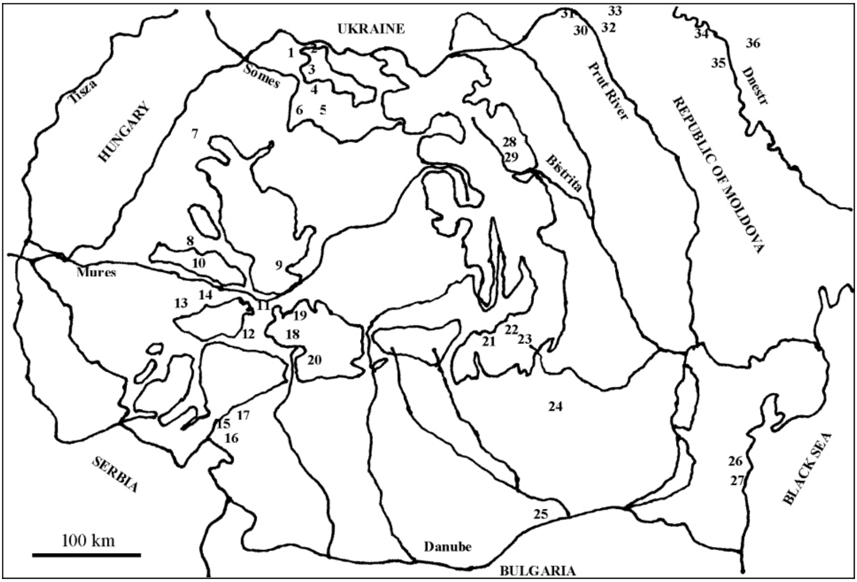


Figure 9.1. Distribution of late Middle and early Upper Paleolithic sites in Romania and adjacent regions: 1. Călineşti II; 2. Boineşti; 3. Remetea Somoş I and II; 4. Buşag; 5. Perii Vadului; 6. Cuciulat; 7. Igriţa; 8. Iosăşel; 9. Ciurului-Izbuc and Vârtop; 10. Cladova; 11. Spurcată and Curată Caves at Nandru; 12 Cioarei Cave at Boroşteni; 13. Tincova; 14. Româneşti and Coşava; 15. Popovaci and Cerbului Cave (Szarvasbarlang); 16. Livadiţa; 17. Hoţilor Cave at Băile Herculane; 18. Bordul Mare at Ohaba Ponor; 19. Cioclovina; 20. Muierilor Cave at Baia de Fier; 21. Peştera; 22. Gura Cheii at Rîşnov; 23. Szitabodza (Cremenea); 24. Lapoş 25. Giurgiu-Malu Roşu; 26. La Izvor at Cheia and La Adam; 27. Mamaia Sat; 28. Bistricioara-Lutărie; 29. Cetăţica Ceahlău; Cetăţica II; Dârţu and Podiş Ceahlău; 30. Ripiceni-Izvor; 31. Mitoc-Malu Galben; Mitoc-Pîrîul lui Istrati and Mitoc-Valea Izvorului; 32. Corpaci and Corpaci-Mas; 33. Brynzeni

Cave; 34. Bobuleşti; 35. Scoc; 36. Climăuţi.

Another important barrier in understanding the behavioural changes that took place between the Middle and the Upper Palaeolithic is the predominance of typologically-oriented research in Romania. Material analysis in this country has been most commonly confined to typological assessments of the lithic artifacts and the classification of assemblages based on dominant lithic types. This dominant research pursuit not only left many important aspects of human behaviour, such as raw material procurement, tool manufacture, tool use, subsistence behaviour, mobility and site-use strategies, social and artistic behaviour outside the domain of scholarly interest, but it also resulted in some narrow-minded conclusions with respect to the Middle to Upper Palaeolithic transition. Current research involving technological analyses of the core and debitage assemblage from late Middle Palaeolithic and early Upper Palaeolithic sites in northeastern Romania (Horvath 2003, 2004) revealed that, while remarkable micro-regional differences exist in the development of the earliest Upper Palaeolithic in the area, the technology used during the early Upper Palaeolithic was less ‘archaic’ than previously implied based on typology alone. Core reduction and tool manufacture at these sites retained some Mousterian elements, but in general, it had a more Upper Palaeolithic character. Typologies emphasize the heavy presence of pieces with notches and denticulated edges in early Upper Palaeolithic assemblages, but these studies ignore modifications resulting from edge wear, accidental damage and hafting alterations. Similar studies are yet to be expanded to other regions of the country and it is believed the combination of multiple research approaches to the study of early Upper Palaeolithic assemblages will help refine the understanding of the Middle to Upper Palaeolithic transition in Romania.

Chronological background to the Middle to Upper Palaeolithic transition in Romania

In Romania, behavioural changes that signal the arrival of the Upper Palaeolithic first emerge after 40,000 BP, during the Hengelo Interstadial, which in Romania is referred to as the Nandru 4b Interstadial (43,000 to 37,700 BP). The real transition from the Middle to the Upper Palaeolithic occurred during the Ohaba (Arcy-Kesselt) Interstadial, which has been chronometrically dated in Romania between 30,500 and 27,000 BP (Cârciumaru 1993, 1999). Compared to the earlier Middle Palaeolithic, the end of this period and the beginning of the early Upper Palaeolithic are more systematically dated in Romania (Table 9.1).

The Ohaba Interstadial is marked by two important evolutionary events that for several millennia developed side-by-side in the Romanian Palaeolithic. On the one hand, Mousterian technologies continued to exist in the Southern Carpathians. Past excavations and a series of chronometric dates signal the persistence of Middle Palaeolithic industries after 30,000 BP in at least three caves. Gura Cheii at Rîşnov, Spurcată Cave at Nandru, Bordul Mare at Ohaba Ponor provided a total of four radiocarbon dates for late Mousterian components, which cluster between 30,000 and 28,700 BP, and pollen record at a fouth site, Curată Cave at Nandru may be correlated with the same time interval (Cârciumaru 1980, 1985, 1999).

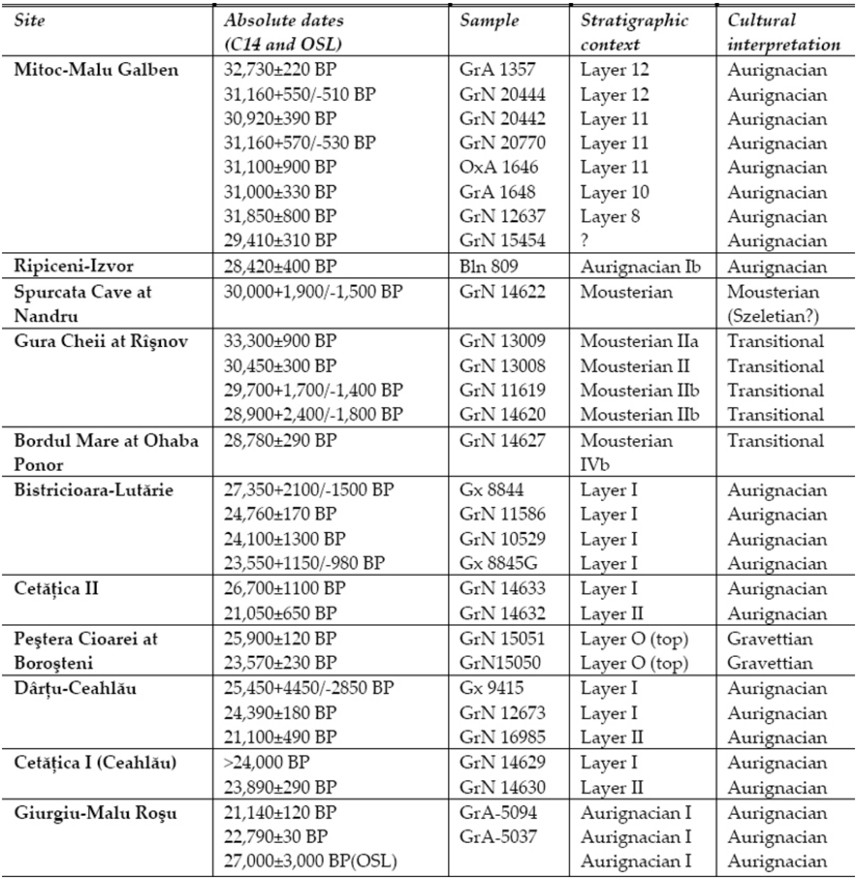
The onset of the Ohaba A interstadial also coincides with the spread of the earliest true Upper Palaeolithic in Romania. The oldest chronometrically dated Upper Palaeolithic site in Romania is Mitoc-Malu Galben in northeastern Romania, where five radiocarbon dates fall between 30,000 and 32,000 BP (Damblon *et al.* 1996). However, there appears to be a small chronological gap between this site and the rest of Upper Palaeolithic sites assigned to the Aurignacian, all of which postdate 29,000 BP (Table 9.1). Recent dating results also reveal that in this country modern human remains were found to pre-date the arrival of modern human culture. The oldest site with anatomically modern humans is the most recently discovered hominid site, Peştera cu Oase in southwestern Romania. Here, remains of three anatomically modern human individuals were dated to 34,900 BP (Trinkaus *et al.* 2003a, 2003b). Two other archaeological sites with hominid remains located not far from this site, Cioclovina and Muierilor Cave at Baia de Fier yielded remains of AMHs, which were directly dated to 31,150 BP and 29,000 BP, respectively (Olariu *et al.* 2004). As the Peştera cu Oase hominids pre-date the earliest Upper Palaeolithic in Romania by as much as 3000 years, a valid question that emerges is who were the people who first made Upper Palaeolithic tools in Romania? Unfortunately, the three aforementioned sites are in a difficult position to answer this question. Peştera cu Oase lacks any cultural remains and the two other sites provided dates on hominid remains that were excavated in the past and are poorly correlated with the stratigraphic context. Evidence from these sites leads to two equally plausible hypotheses. One possibility is that the earliest moderns possessed a new technology and behaviour, but the sites that reveal this type of behaviour have not yet been excavated or dated. It is equally possible that the first modern people who reached the Carpathians employed a technology that was essentially indistinguishable from that of their Middle Palaeolithic contemporaries. If this were the case, some of the late Mousterian components of the Southern Carpathians may in fact be the creation of AMHs. The archaeological record leaves both of these possible interpretations open for discussion; chronologically the earliest Upper Palaeolithic overlaps in time with the late Middle Palaeolithic in Romania, but at sites that were occupied throughout this sequence, the former was always found superimposed to the latter and there is no indication for inter-stratification between the two components. It is up to future research to clarify the relationship between the earliest moderns in Romania and the archaeological industries that developed during the later Middle Palaeolithic and the earlier Upper Palaeolithic.

Alongside late Mousterian and early Upper Palaeolithic (Aurignacian) cultures, several ‘transitional’ industries developed in Romania between 40,000 and 25,000 BP. Some of these are built on the local Mousterian, which appears to be the case with the Brynzenian and the Szeletian, while others, like the Prut culture or the Corpaci-facies are more Upper Palaeolithic in nature. These transitional industries with Upper Palaeolithic elements are in fact more common than true Aurignacian sites in Romania. Stratigraphic uncertainties have limited dating efforts at most transitional sites, but, based on the available dates, it appears that all transitional and early Upper Palaeolithic industries developed after 30,000 BP.

These transitional and non-Aurignacian early Upper Palaeolithic cultures in Romania did not develop in isolation from similar cultural manifestation in adjacent regions. Sites in northeastern Romania shared particularly close ties with assemblages located to the left of the Prut River Valley and the Prut-Dnestr

Interfluve. The Brynzenian, the Prut culture and the Corpaci-facies are manifestations of cultural behaviour that connected the northeastern Romanian Plain to sites located further east. On the other hand, assemblages in northwestern Romania (Oaş region), western Romania (Transylvania) and the Southern Carpathians exhibit more similarities with Central European transitional industries, primarily the Szeletian.

Table 9.1. Absolute dates for early Upper Paleolithic sites in Romania.



Site	*Absolute dates (C14 and OSL)*	*Sample*	*Stratigraphic context*	*Cultural interpretation*
Mitoc-Malu Galben	32,730±220 BP 31,160+550/-510 BP 30,920±390 BP 31,160+570/-530 BP 31,100±900 BP 31,000±330 BP 31,850±800 BP 29,410±310 BP	GrA 1357 GrN 20444 GrN 20442 GrN 20770 OxA 1646 GrA 1648 GrN 12637 GrN 15454	Layer 12 Layer 12 Layer 11 Layer 11 Layer 11 Layer 10 Layer 8 ?	Aurignacian Aurignacian Aurignacian Aurignacian Aurignacian Aurignacian Aurignacian Aurignacian
Ripiceni-Izvor	28,420±400 BP	Bln 809	Aurignacian Ib	Aurignacian
Spurcata Cave at Nandru	30,000+1,900/-1,500 BP	GrN 14622	Mousterian	Mousterian (Szeletian?)
Gura Cheii at Rîşnov	33,300±900 BP 30,450±300 BP 29,700+1,700/-1,400 BP 28,900+2,400/-1,800 BP	GrN 13009 GrN 13008 GrN 11619 GrN 14620	Mousterian IIa Mousterian II Mousterian IIb Mousterian IIb	Transitional Transitional Transitional Transitional
Bordul Mare at Ohaba Ponor	28,780±290 BP	GrN 14627	Mousterian IVb	Transitional
Bistricioara-Lutărie	27,350+2100/-1500 BP 24,760±170 BP 24,100±1300 BP 23,550+1150/-980 BP	Gx 8844 GrN 11586 GrN 10529 Gx 8845G	Layer I Layer I Layer I Layer I	Aurignacian Aurignacian Aurignacian Aurignacian
Cetăţica II	26,700±1100 BP 21,050±650 BP	GrN 14633 GrN 14632	Layer I Layer II	Aurignacian Aurignacian
Peştera Cioarei at Boroşteni	25,900±120 BP 23,570±230 BP	GrN 15051 GrN15050	Layer O (top) Layer O (top)	Gravettian Gravettian
Dârţu-Ceahlău	25,450+4450/-2850 BP 24,390±180 BP 21,100±490 BP	Gx 9415 GrN 12673 GrN 16985	Layer I Layer I Layer II	Aurignacian Aurignacian Aurignacian
Cetăţica I (Ceahlău)	>24,000 BP 23,890±290 BP	GrN 14629 GrN 14630	Layer I Layer II	Aurignacian Aurignacian
Giurgiu-Malu Roşu	21,140±120 BP 22,790±30 BP 27,000±3,000 BP(OSL)	GrA-5094 GrA-5037	Aurignacian I Aurignacian I Aurignacian I	Aurignacian Aurignacian Aurignacian

The early Upper Palaeolithic in Romania

Traditionally, Romanian archaeologists employed a linear evolutionary model for describing human cultural evolution, and payed very little attention to transitional episodes. No real progression was recognized from the late Mousterian to the early Upper Palaeolithic, leading Romanian archaeologists to assign all early Upper Palaeolithic industries to the Aurignacian, which was thought to be a direct successor to the local Mousterian. This resulted in a significant over-use of the term 'Aurignacian' to describe almost any early Upper Palaeolithic assemblage that either postdates the Mousterian or has a more ‘evolved’ character (Păunescu 1970, 1980, 1984, 1988, 1989a, 1993). Renewed research and more recent publications authored by a younger generation of scholars has revealed that the Aurignacian is a rare occurrence in the Romanian early Upper Palaeolithic, and non-Aurignacian Upper Palaeolithic industries were much more common during this time period. However, not all such early Upper Palaeolithic industries have been perceived as being equally relevant for the evolution of human culture in this region. Ideological biases had a particularly strong effect on the understanding and acceptance of transitional industries that had connections with regions located to the west, such as the Szeletian. Up until the late 1960, Romanian archaeologists widely recognized the Szeletian (earlier referred to as the Solutrean) as an archaeological/cultural entity that extended its influence over some parts of this country (Nicolăescu-Plopşor 1957). By the early 1970s, the term ‘Szeletian’ was dropped and it has become practically abolished in the Romanian archaeological literature, largely under the influence of nationalistic sentiments and the pressures imposed by the ideological prophecies of a harshening socialist regime. With its external, Central European roots, the Szeletian was seen as a reflection of western influence on the evolution of the local Palaeolithic culture and a threat to the celebration of the cultural capabilities and achievements of the local population. With very few exceptions (Jungbert 1977), the norm in Romanian Palaeolithic archaeology has become to discredit the idea that the Szeletian was manifested in Romania. The more recent decades were marked by a resurgence of interest in the evolutionary processes that took place between the Middle and the Upper Palaeolithic and a more astute research in the different transitional industries, including the Szeletian.

The earliest securely dated and systematically excavated Aurignacian site in Romania, Mitoc-Malu Galben has a rich lamellar lithic assemblage that is dominated by carenated end-scrapers and burins (Otte and Chirica 1993) (Figure 9.2). The production of blanks commonly proceeded with one-directional blank removal from Upper Palaeolithic-type cores, with frequent use of lateral or central guiding crests (Otte *et al.* 1996a). In collections excavated between 1980 and 1990, flakes outnumber blades in the debitage assemblage, but this may be due to less systematic artifact recovery and/or poor curatorial practices. Transitional elements are missing, and only a very small percentage of the cores are reduced with the discoid or Levallois method. These sporadic archaic elements occur at different depths throughout the Aurignacian deposit, hence their presence in the assemblage cannot confirm claims made earlier (Nicolăescu-Plopşor and Zaharia 1959) about the existence of a small Mousterian component at the base of the archaeological deposit at Mitoc-Malu Galben. Bifacial leaf-points, present at neighbouring early Upper Palaeolithic sites, are missing at Mitoc-Malu Galben. The Aurignacian character of the assemblage is also attested also by the presence of one Mladec-type antler point (Chirica 2001). The unusually large percentage of carenated end-scrapers and carenated burins at this site is not matched by any other early Upper Palaeolithic site in Romania, leaving only a few Upper Palaeolithic sites located further east, in Moldavia, Ukraine and Crimea as possible sources of analogy. Mitoc-Malu Galben has been most commonly compared to eastern Aurignacian sites with a lamellar technology, rich in carenated end-scrapers and burins from Moldavia (Corpaci-Mas, Climăuţi II), Ukraine (Rashkov

VII) and Crimea (Siureni I) (Otte *et al.* 1996a, 1996b). With the exception of Siureni, these analogies are, unfortunately, based on sites that are either undated (Corpaci-Mas, Rashkov VII) or chronologically younger (Climăuţi II) than Mitoc-Malu Galben.

The other nine early Upper Palaeolithic sites in northeastern Romania that are classified as Aurignacian (Păunescu 1999a) do not exhibit definitive Aurignacian characteristics. Among those, the largest and most frequenly referred to site, Ripiceni-Izvor has an early Upper Palaeolithic component that, contrary to original claims (Păunescu 1988, 1989a, 1993, 1999a), is devoid of typical Aurignacian elements. The predominance of flakes in the debitage assemblage and the presence of denticulated and notched implements, Levallois cores and products, as well as bifacial points (Figure 9.3), alongside end-scrapers, burins, crested blades, bladelets and prismatic cores is indicative of a technological and typological mixture of Middle and Upper Palaeolithic elements, which, according to some, may be connected to the local Szeletian (Kozlowski 1988), the transitional Brynzeni culture of the Prut-Dnestr Interfluve (Chirica *et al.* 1996a, 77–78; Chirica 1998), the techno-typologically more advanced Upper Palaeolithic Prut culture (Borziak 1994; Chirica *et al.* 1996a; Otte *et al.* 1996a; Noiret 2004), or the Corpaci-type Upper Palaeolithic (Păunescu 1988; Chirica *et al.* 1996a, 78; Otte *et al.* 1996a; Kozlowski 2004).

In the Eastern Carpathians the earliest human settlements date back to the earlier Upper Palaeolithic, but, due to a poor understanding of the stratigraphy and very limited material analyses, the cultural affinities of the first groups who used these sites remains debated. Here, Upper Palaeolithic sites concentrate on lower-lying river terraces, primarily along the middle section of the Bistriţa River. Chronometric dates position these sites between 27,000 and 21,000 BP. In the lowermost, still un-dated assemblage from Cetăţica I – Ceahlău, there is a mixture of Middle Palaeolithic (a predominantly flake debitage, bifacial leaf-points) and Upper Palaeolithic (prismatic cores, Upper Palaeolithic-type tools) elements (Bitiri 1965b). The upper assemblage at this site, as well as that from the nearby Cetăţica II, Bistricioara Lutărie, Dârţu, and Podiş-Ceahlău exhibit a lamellar technology and an Upper Palaeolithic tool inventory that is carefully executed in spite of the poor quality of the local raw material (Cârciumaru 1999, 138–139). Although sporadic Aurignacian-type artifacts, such as Aurignacian blades, carenated end-scrapers, Dufour bladelets and one atypical bone point (Păunescu 1996; Beldiman 2000) are present, the early Upper Palaeolithic sites in the Ceahlău Basin cannot be conclusively classified as Aurignacian. Beyond their cultural affiliation, the emergence of these sites in the Eastern Carpathians carries a greater regional significance. The early Upper Palaeolithic sites in the Bistriţa River Valley are strategically positioned along a major route of access through the Carpathians, connecting the Transylvanian uplands to the west with the plains to the east. The earliest groups who used these locations were very likely in transit from one side of the mountains to the other, moving not only physically across the landscape but carrying materials along. Studies on raw material procurement reveal that the groups who first used these locations relied on a greater variety of raw materials, compared to contemporary sites elsewhere (Nicolăescu-Plopşor *et al.* 1966, Păunescu 1998, Cârciumaru 1999). The source of most of these materials has not yet been identified, but it is known that flint from the Prut River Valley was one of the materials that was brought to the Eastern Carpathians and, from there, it reached early Upper Palaeolithic communities in northern Transylvania (Dobrescu 2003, 60–61). Black schist from the Eastern Carpathians was transported to early Upper Palaeolithic sites on the Prut (Ripiceni-Izvor) and Moldavia (Noiret 2004). The mobile early Upper Palaeolithic groups who used these Esatern Carpathian sites also brought with them finished products, as attested to by several bifacial points from the lower assemblage at Cetăţica I, which are made out of a type of flint that is exotic to this region (Bitiri 1965b, 441).

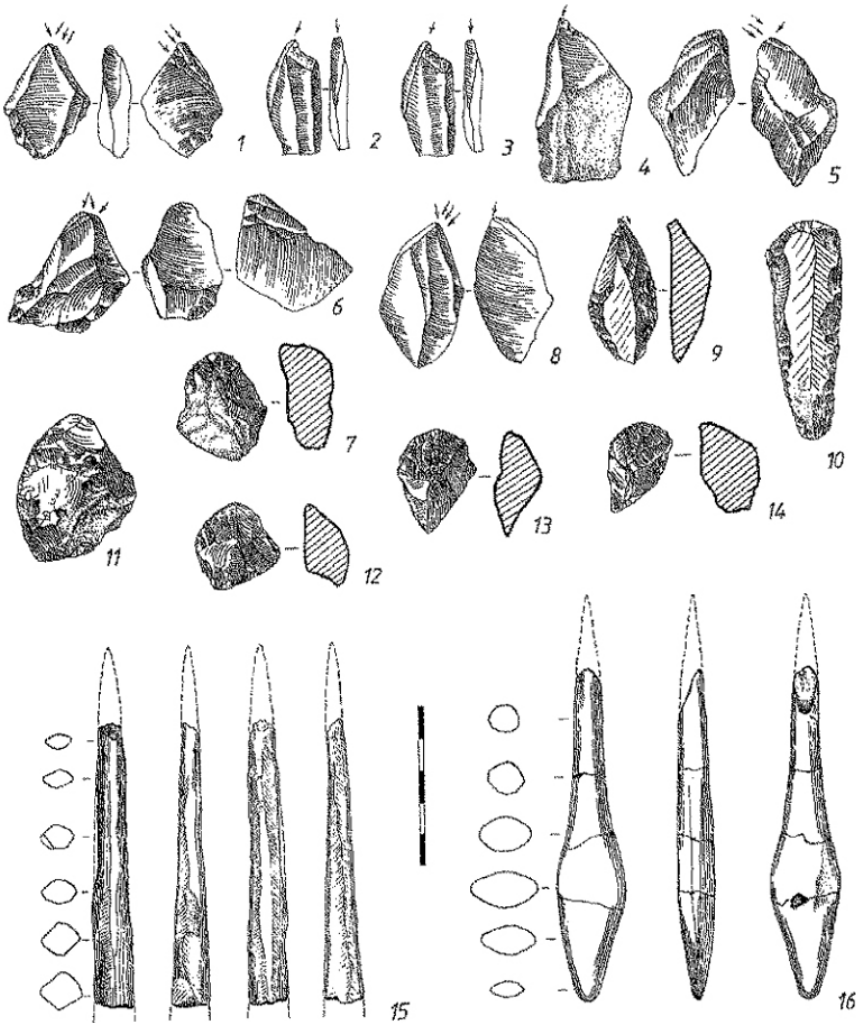


Figure 9.2. Aurignacian artifacts, bone point fragment and Mladec-type bone point, Mitoc-Malu Galben. (After Păunescu 1999a,154).

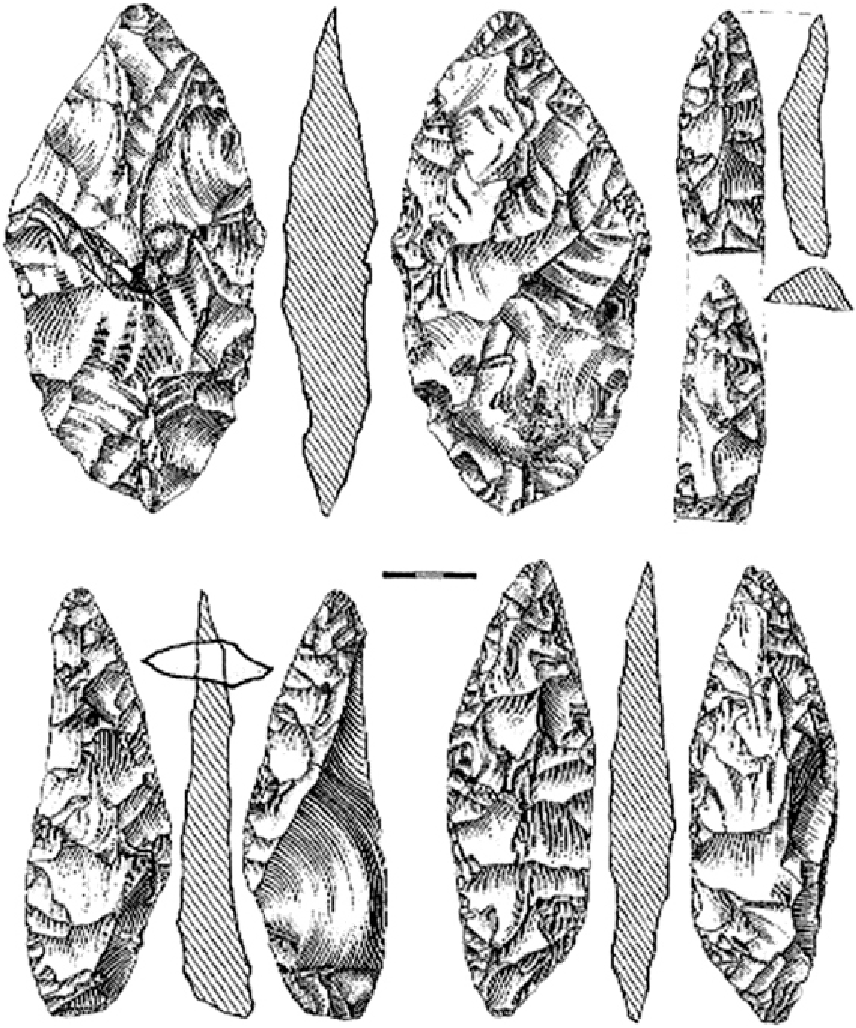


Figure 9.3. Bifacial leaf-points, Ripiceni-Izvor, Mousterian layer IV. (After Păunescu 1999a, 218).

In Transylvania, the Aurignacian has been very poorly researched and it remains still undated. A more recent evaluation of the material from Buşag, in northern Transylvania (Dobrescu 2001, 2003) confirmed the presence of the Aurignacian in the region (Bitiri 1972a, 1972b). Buşag has a lamellar technology and it contains many carenated and nosed end-scrapers, as well as Aurignacian retouched blades, although flake debitage and sporadic notched tools and side-scrapers are also present in the assemblage (Dobrescu 2001, 2003). The rest of neighboring sites in Oaş, Călineşti I and II, Boineşti, Remetea-Somoş I and II and Perii Vadului, are generally classified as Aurignacian, but unlike Buşag, these have very few true Aurignacian technological and typological elements (Păunescu 2001). Two other sites in Transylvania, Igriţa Cave and Szitabodza may be classified as Aurgnacian, but both are very poorly known and were only summarily excavated in the early 20th century. Igriţa Cave in central Transylvania, was excavated between 1913 and 1924 and it yielded both Mousterian and early Aurignacian lithic artifacts mostly made out of quartzite, numerous bone tools, including a tip fragment of a bone point (Roska 1926, 1931b; Bitiri 1965a; Boroneanţ 2000, 6–7). A richer and later Aurignacian occupation may be represented at Szitabodza (also known as Sita Buzăului or Cremenea), an open-air site in the southeastern corner of Transylvania, in the valley of the Buzău River. Test excavations revealed the existence of a very large and rich site that yielded mostly Aurignacian artifacts, especially blades and end-scrapers, as well as Szeletian leaf-points and numerous hearths (Roska 1924, 1925b, 1926, 1927b, 1931a, 1931b; Kadic 1934). Although no systematic excavations were conducted at this site, the richness and diversity of archaeological material indicates that the site was repeatedly used over a long time during the early Upper Palaeolithic.

Alongside the Aurignacian, several transitional industries developed in Romania during the early Upper Palaeolithic. The Brynzeny culture, named after Brynzeni Cave in Moldavia, is manifested at several sites in northeastern Romania. This culture, probably derived from a local denticulated Mousterian tradition, known as the Stinkovian, is characterized by a high proportion of denticulated, notched and bifacially worked pieces, including leaf-points, but it also contains retouched blades, end-scrapers and prismatic blade cores (Amirkhanov *et al.* 1993; Chirica 1998; Chirica *et al.* 1996a, 167–168, 176–177; Otte *et al.* 1996a; Cohen and Stepanchuk 1999; Kozlowski 2000). Some view the Brynzenian as a Szeletoid-type transitional industry (Kozlowski and Otte 1990; Borziac *et al.* 1993). On the Moldavian side of the Prut River, the Brynzeny is known from Brynzeni Cave (lower assemblage), Bobuleşti VI, Ciontu Cave (lower layer) and Scoc (Borziac 1994; Chirica *et al.* 1996a; 88; Chirica 1998), while in Romania, the lower component at Mitoc-Valea Izvorului and the early Upper Palaeolithic component at Ripiceni-Izvor may be part of this tradition (Chirica *et al.* 1996a, 183; Chirica 1998). Available chronometric dates place this industry much later than initially thought, between 26,000 (or 28,000 BP, if layer Ib from Ripiceni-Izvor Ib is included in this tradition) and 14,000 BP (Chirica *et al.* 1996a; Otte *et al.* 1996a; Kozlowski 2004; Vishnyatsky and Nehoroshev 2004), but unresolved stratigraphic problems at Brynzenian sites make these dates tentative.

In Romania, some archaeologists prefer the term Mitoc-facies to describe Brynzenian-type assemblages (Bitiri and Cârciumaru 1978, 1981; Cârciumaru 1995, 1999). This label is applied to sites that have been traditionally described as either late Mousterian (Mousterian layers IV and V from Ripiceni-Izvor, the lower assemblage at Mitoc-Valea Izvorului) or early Upper Palaeolithic (the Aurignacian and possibly the Gravettian layers at Ripiceni-Izvor, and the upper component at Mitoc-Valea Izvorului). Again, these assemblages are grouped together based on typological grounds; all have a high percentage of denticulated and notched pieces and fewer end-scrapers, burins, bifacial tools and side scrapers (Bitiri and Cârciumaru 1981). The Mitoc facies is understood as a transitional unit that has its roots in the local Mousterian and which developed in parallel with the late Carpathian Mousterian and the archaic Upper Palaeolithic in the Bistriţa Valley and northern Transylvania. According to some, this tradition evolved directly into the Upper Palaeolithic in the Middle Prut Valley (Cârciumaru 1999).

A similarly Mousterian-based, but more Upper Palaeolithic-like transitional culture that developed on the Romanian and Moldavian side of the Prut River is the Prut culture. This label has been used for assemblages that are bladier and contain a higher proportion of Upper Palaeolithic tool types, while they retain some Mousterian elements, especially notches, denticulates and bifaces. Bifacial points that show up at these sites are either elongated and have a round base, or are small and triangular, similar to the Streletskaya points with concave bases (Borziac 1994; Chirica *et al.* 1996a; Otte *et al.* 1996a, 1998). The age of this transitional culture remains unknown, as are its exact links to the Middle or the Upper Palaeolithic of the area. This culture has been variably described as sharing commonalities with the Aurignacian (Borziac 1994), the local Mousterian (Borziac 1994, 25; Chirica 2001, 116), the Streletskayan of the Central Russian Plain (Noiret 2004), or the Gravettian (Kozlowski and Otte 1990, 543). Based on typological criteria, especially the presence of several finely shaped, triangular bifacial points with concave bases in the 'Aurignacian layer IIb, Ripiceni-Izvor has been linked to the Prut culture (Păunescu 1993, 150; Borziac 1994; Chirica *et al.* 1996a, 88; Otte *et al.* 1996a, 49–50; Cohen and Stepanchuk 1999; Noiret 2004).

In the Corpaci-type early Upper Palaeolithic industry technological and typological elements of Middle Paleolithic nature, such as side scrapers, denticulates, bifaces and Levallois flakes occur alongside Upper Palaeolithic artifacts and prismatic blade cores. As revealed by the type assemblage at Corpaci (layer 4), on the left side of the Prut River, this industry has a microlithic component and it contains characteristic arched backed blades or segments (Grigorieva 1983; Otte *et al.* 1996a). The presence of four lunates in the 'Aurignacian' layer IIb at Ripiceni-Izvor, has long been implied to indicate some links between this archaeological component and Corpaci (Păunescu 1988, 1989a, 1993, 148–150, 199; Chirica *et al.* 1996a, 78). More recently, the association between these two sites has been expanded by Kozlowski (2004), who suggests that Ripiceni-Izvor (layer IIb), Corpaci (layer 4), as well as Kraków-Zwierzyniec in Poland were part of an eastern arched backed blade-dominated early Upper Palaeolithic tradition that first emerged in northeastern Europe shortly after 40,000 BP and it gradually expanded eastward, reaching the Western Russian Plain between 28,000 and 25,000 years ago. Just like their western and south European contemporaries, the Chatelperronian and the Uluzzian, the northeastern backed blade industries are characterized by a mixture of Middle and Upper Palaeolithic technological and typological elements, but they probably developed along separate evolutionary lines, stemming from local Mousterian traditions (Kozlowski 2004). Ripiceni-Izvor shares some of the attributes of the northeastern early Upper Palaeolithic tradition with arched backed blades, but not all. Just like other sites of this tradition, the 'Aurignacian' layer IIb at Ripiceni-Izvor has a strong microlithic component. A study of 676 lithic specimens kept in storage from layer IIb shows that, while unretouched and retouched flakes remained predominant in the tool and debitage assemblage, the bladelet component increased sharply in this assemblage, relative to earlier Upper Palaeolithic layers at the site, accounting for over 20 % of the artifacts in the collection. However, very few of the bladelets at Ripiceni-Izvor are retouched, and the few backed blades and bladelets that are present in this assemblage (just over 30 specimens) have cortical or minimally retouched backs, pointing to very little similarity between this site and the assemblages from layers 12 and 13 at Kraków-Zwierzyniec and that from layer 4 at Corpaci that are rich in truncated and arched blades (Kozlowski 2004, Figure 2.3, 2.5, 2.7). Similarly, Zwierzyniecian sites have a higher percentage of blades in the tool and debitage assemblage, compared to Ripiceni-Izvor (Păunescu 1993, 148–152; Kozlowski 2004). Whether part of the Corpaci-facies or the Zwierzyniecian tradition, the Upper Palaeolithic assemblage of layer IIb at Ripiceni-Izvor signals the presence in northeastern Romania of an early Upper Palaeolithic microlithic technology. Further investigations would need to explore the links between this and other transitional entities with microlithic components, as well as the Gravettian (Allsworth-Jones 1986, 1990).

A common characteristic of the Brynzeni, Prut, Mitoc and Corpaci-type early Upper Palaeolithic industries is the co-occurrence of bifacial foliate points with technological and typological elements that are typical of the Upper Palaeolithic. This raises the question of Szeletian presence in Romania. While there is little agreement on the way the Szeletian has been defined, described and dated in Central Europe, most believe that this industry did not spread eastward beyond the Carpathian Basin and it did not reach Romania (Păunescu 1993; Chirica *et al.* 1996a; Cârciumaru 1999) or the Russian Plain (Hoffecker 1988). Even if not directly present, the Szeletian may have emanated its influence beyond the Eastern Carpathians and, merging with local traditions, it probably helped crystallize local Szeletoid variants, such as the Brynzenian along the Prut River Valley (Kozlowski 1988; Kozlowski and Otte 1990; Borziac *et al.* 1993). However, in closer proximity to the Bükk Mountains of northeastern Hungary, the Szeletian had a much stronger presence, as signaled by a number of open-air sites in Transylvania and cave sites in the Southern Carpathians. The largest of these is Iosăşel, a poorly and summarily excavated open-air site in central Transylvania. Here, surface surveys and test excavations yielded a rich collection of lithic artifacts that include hand axes (some of Micoquian type), bifacial leaf points, end-scrapers, as well as discoid and prismatic blade cores (Roska 1924, 1925a, 1926, 1927a, 1928, 1929a, 1931a, 1931b, 1933, 1942; Nicolăescu-Plopşor 1957; Bitiri 1965b; Jungbert 1977; Allsworth-Jones 1986, 82). The location of this site, directly on a raw material source (opal) and the richness of the archaeological material indicates that this was an important and frequently used location for raw material exploitation and primary knapping. According to initial excavation reports, the site has three archaeological layers, all of which contain very similar cultural material (Roska 1931a), but the possibility of mixture of materials from different contexts is yet to be explored. This site has later been incorrecly interpreted as a non-Szeletian early Upper Palaeolithic site that yielded only two bifacial leafpoints (Nicolăescu-Plopşor 1957), although original site reports make reference to as many as 17 leafpoints.

Not far from Iosăşel, Spurcată Cave at Nandu in the Southern Carpathians yielded a smaller collection of Mousterian artifacts mixed in with some large blades and bifacial leafpoints, in what appears to be a single occupational layer (Cârciumaru 1999, 87–88). While the Mousterian artifacts look similar to those recovered at other late Mousterian Carpathian cave sites, Spurcată Cave has an unusually large percentage (40%) of artifacts made out of non-local flint (contemporary Carpathian cave sites relied almost exclusively on locally available quartzite) and a much larger number of foliate points, in comparison to neighbouring cave sites. According to some, these characteristics warrant the classification of this site as Szeletian (Nicolăescu-Plopşor 1957; Jungbert 1977). Of the possible Szeletian sites in western Romania, this is the only one that has been chronometrically dated. The 30,000 +1,900/-1,500 BP date available for this single component site falls within the more recently published age-range for the Hungarian Szeletian (Adams 2002; Adams and Ringer 2004). Sporadic findings of bifacial foliate points in northwestern Romanian early Upper Palaeolithic sites, especially at Remetea-Somoş I and Boineşti have also been linked to the Szeletian (Bitiri 1965b; Jungbert 1977; Allsworth-Jones 1986, 55), but here too, archaeological assessment is hampered by stratigraphic mixture of cultural material of various ages. These sites are located relatively close to Szeleta Cave in northeastern Hungary, and it is hoped that with a renewed interest in the Szeletian, future research will look more closely at the possible links between these Romanian sites and the Szeletian.

Changes in human behavior at the Middle to Upper Paleolithic transition

The previous section built on typological assessments of early Upper Palaeolithic assemblages in Romania. This does not provide an integral view regarding the Middle to Upper Palaeolithic transition. Other, non-technological aspects of human behaviour were also affected by the changing cultural and physical environment and a comprehensive discussion on the Middle to Upper Palaeolithic transition in Romania would need to evaluate behavioural changes more broadly. By looking at tool-making behaviour, land and resource use, mobility, resource procurement, site organization and symbolic behaviour, more accurate conclusions can be drawn about changes and gradual progression in the early Upper Palaeolithic human behaviour.

Lithic technology is very poorly researched in Romania, and research in this domain generally does not go beyond descriptive core analyses. A recent technological study on late Mousterian and early Upper Palaeolithic assemblages in northeastern Romania revealed that technological evaluation of the debitage and core assemblage can more accurately assess the presence of either Middle Palaeolithic or Upper Palaeolithic tool manufacturing traditions. Analyses performed on the early Upper Palaeolithic tool, debitage and core collection from Ripiceni-Izvor (‘Aurignacian’ layers Ia, Ib, IIa, IIb), totaling over 1800 specimens, has shown that, when notched tools, denticulates and bifacial leafpoints are excluded from the tool inventory, the assemblage appears to be more Upper Palaeolithic in nature. Among the cores (n = 25), prismatic and pyramidal cores predominate and the few discoid, Levallois and Middle Palaeolithic-type flat cores do not reveal crest preparation or other indications for the merging of Middle and Upper Palaeolithic reduction methods.

Similarly, Mitoc-Valea Izvorului, described as transitional on typological grounds, is dominated by a core assemblage that is mostly Upper Palaeolithic in nature. Of the 187 cores kept in storage from this site, over 33% are prismatic, 6.4% are pyramidal, and over 3% are carenated. Bladelet cores are present too, accounting for over 8% of the core assemblage. True flake cores make up half of the assemblage, the rest consisting of combination flake-and-blade cores, as well as specialized blade cores. However, Middle Palaeolithic-type flat cores, discoid and Levallois cores have a stronger presence at this site, compared to the early Upper Palaeolithic assemblage at Ripiceni-Izvor, making up ~23% of the core collection. Although no true composite Middle and Upper Palaeolithic-type core was identified at Mitoc-Valea Izvorului, there is a greater use of Upper Palaeolithic core preparation methods. Close to 30 % of the Middle Palaeolithic-type flat cores have lateral crests, while central guiding crests were most commonly applied to prismatic cores. Just like Ripiceni-Izvor, Mitoc-Valea Izvorului was described as a transitional site, largely based on the presence of a very large number of denticulated and notched implements (Bitiri and Cârciumaru 1978). The use of these typological categories does not take into account other functional considerations, such as hafting or accidental edge modifications. At Mitoc-Valea Izvorului, over 80 retouched artifacts were deliberately modified at the base to allow them to fit into handles and many of these specimens may be typologically classified as notches. These preliminary data suggest that the early Upper Palaeolithic in northeastern Romania was marked by changes in tool production, and technological analyses are better equipped than traditional typologies to address these changes. Yet, the extent and pace of change was not uniform across this region, and more research and inter-site comparisons are needed to build a more integral view on the different lithic technologies employed during the early Upper Palaeolithic.

A comparison between the distribution of late Middle and early Upper Palaeolithic sites over the topographically extremely varied landscape of Romania reveals that site location and resource use practices remained constant in some parts of the country, particularly along water courses and low-lying areas, while in other regions, especially the uplands, Upper Palaeolithic groups came equipped with different mobility and adaptive strategies. In the northeastern Romanian Plain and most of the Carpathian Basin, early Upper Palaeolithic sites are often found superimposed on late Middle Palaeolithic habitations, indicating similar choices in land and resource use. Site location preferences changed, however, in the highlands. In the Southern Carpathians, caves seem to have been less favored by Upper Palaeolithic people, and the sites that were used during the Upper Palaeolithic are ephemeral; cultural remains consist of a handful of stone tools and rare hearths. While changing climate may have played a role in driving these changes in the Carpathians, it appears that Upper Palaeolithic groups were more mobile than their predecessors and were possibly connected to larger social networks that were spaced over greater geographic areas. Similar behavioural changes took place in the Eastern Carpathians. Here, indications for Middle Palaeolithic habitation are missing, but during the early Upper Palaeolithic a number of sites emerged, especially at strategic locations of access, along river valleys. Beyond greater degree of mobility, these changes indicate that Upper Palaeolithic people had superior environmental knowledge and were better equipped to handle long-distance travels on treacherous terrains. Good mental maps allowed Upper Palaeolithic groups to travel though the Carpathians relatively easily and remain below an elevation of 1200 meters.

In selecting campsites, both Middle and Upper Palaeolithic people preferred locations that offered easy access to usable stone materials. Along the middle and lower sections of the Prut River, locally available good quality Prut River flint attracted groups of people throughout the Palaeolithic, while in northwestern Romania, late Middle and early Upper Palaeolithic settlements often gravitated near sources of jasper, opal and chalcedony. The inhabitants of Southern Carpathian cave sites took advantage of abundant sources of quartzite to manufacture tools, particularly during the Middle Palaeolithic. Although Middle Palaeolithic groups most commonly relied on local materials, there are instances when materials or finished products traveled over hundreds of kilometers. In the Mousterian layer IV at Ripiceni-Izvor, a large handaxe was made out of a distinct type of yellowish-brown sedimentary rock that is common at Middle Palaeolithic localities in Dobrogea. While in many cases, Upper Palaeolithic sites emerged in the same location and near the same sources of raw material as Middle Palaeolithic sites, the former relied on the local material only if that was of good quality. In the Southern Carpathians, quartzite, while easily accessible, was no longer used during the Upper Palaeolithic and non-local flint became the raw material of choice. Greater selectivity is also evident at Upper Palaeolithic sites in northwestern Romania, where human groups continued to rely on local sources of jasper, opal and chalcedony, but gradually integrated more obsidian (of yet unknown origin) in their tool manufacture (Dobrescu 2003).

Basic subsistence needs and game procurement strategies changed very little over the Middle to Upper Palaeolithic transition. Both Middle and Upper Palaeolithic sites were generally positioned on plateau locations along watercourses that allowed good visual control over seasonal migratory routes of wild game. Late Mousterian and early Upper Palaeolithic sites in the Southern Carpathians are all positioned at an altitude that did not exceed 700 meters above sea level, and they cluster on plateaus or slopes that overlook valley bottoms (Cârciumaru and Dobrescu 1997; Cârciumaru 1999). At these sites, the faunal assemblage is comprised almost entirely of large herbivores, especially horse (*Equus caballus fossilis* and *E. hydruntinus*), elk (*Cervus elaphus*), giant deer (*Cervus megaceros*), ibex (*Capra ibex*), chamois (*Rupicapra rupicapra*), saiga antelope (*Saiga tatarica*), mammoth (*Mammuthus primigenius*), and large bovids (*Bos* and *Bison*). Carnivorous species, such as cave bears, wolf and fox, common at sites that did not yield indications for human habitation, are rare at archaeological sites (Cârciumaru 1999, 69–75). The presence of these gregarious grazing and browsing species at Carpathian cave sites and the strategic location of these sites indicate that the organized pursuit of wild game was as important for both Upper Paleolithic and Middle Palaeolithic groups. The same considerations may have guided Middle and early Upper Palaeolithic groups to concentrate their campsites along the Prut River in northeastern Romania and take advantage of the proximity to both the open steppic landscape and more densely vegetated areas. Here, mammoth (*Mammuthus primigenius*) seems to have been preferred over horse (*Equus transilvanicus*), wooly rhino (*Coelodonta antiquitatis*), bison (*Bison priscus*), elk (*Cervus elaphus*), reindeer (*Rangifer tarandus*) and giant deer (*Megaceros giganteus*) during the Middle Palaeolithic. Mammoth tusks, molars and long bones were also utilized as construction material for temporary shelters during the Middle Palaeolithic at Ripiceni-Izvor (Păunescu 1993). During the Upper Palaeolithic mammoth gradually dissapears in this area, and human groups concentrated more on the procurement of horse and large bovid species (Păunescu 1993, 182–184; Gautier and Lopez-Bayon 1993; Chirica 2001, 99–101).

Similarly, the organization of living space changed very little over the Middle to Upper Palaeolithic transition. Well-defined activity areas, hearths, and, in rare instances, residential structures were identified at both Middle and Upper Palaeolithic sites in Romania. The most common activity areas are lithic workshops that often consist of one or several large limestone blocks that were used as anvils and a cluster of lithic debitage (Păunescu 1993). Concentrations of animal bones have been observed both at Middle and Upper Palaeolithic sites, but in the absence of taphonomic analyses, the function and significance of these remain obscure. Clusters of complete and fragmented bones are especially common in the Mousterian layers at Ripiceni-Izvor, where these are often found in association with large blocks of limestone, lithic tools and debitage (Păunescu 1993). These features could have served as either butchery stations or manufacturing locations of bone or antler implements. According to some reports, artifacts made out of organic materials were present in the Mousterian layers at Ripiceni-Izvor (Moroşan 1938). During the Mousterian, hearths were built both inside cave sites (as at Cioarei Cave at Boroşteni) and open-air sites (at Ripiceni-Izvor and Cladova). Some of these hearths were well-built, stone-lined circular features, while others were larger, more irregular and hastily made (Boroneanţ 1991, 31; Păunescu 1993; Cârciumaru 1999, 76). Cooking pits may also have been used during the Mousterian, as indicated by several smaller features at Ripiceni-Izvor that contain many burnt, low-utility bone fragments and several large flint nodules that may have served as boiling stones (Cârciumaru 1999, 77).

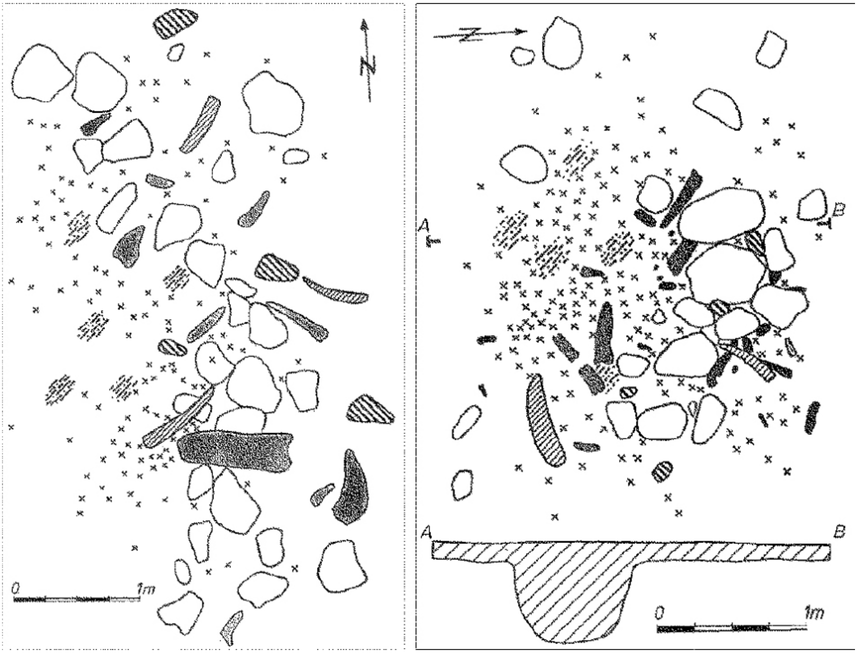


Figure 9.4. Large features, probably shelters at Ripiceni-Izvor, Mousterian layer I and IV. (After Păunescu 1999a).

Middle Palaeolithic sites in Romania occasionally yielded larger and more complex features that reflect an elaborate use of the living space, albeit the function of these is not always clear. At Cioarei Cave at Boroşteni, in the Mousterian component that pre-dates 48,000 BP, excavations uncovered several rectangular arrangements of limestone slabs that are surrounded by darker, carbon-rich soil, fragmented animal bones, lithic artifacts and occasional pieces of ochre (Cârciumaru 1999, 76). These are thought to be man-made arrangements, but their function is yet unclear. Long debates have also surrounded the better-known mammoth-bone structures at Ripiceni-Izvor. Here, three out of the six Mousterian layers contain large circular or elongated concentrations of animal bones, large pieces of limestone and lithic artifacts, which, according to Păunescu (1989b, 1993, 1999a), represent the remains of temporary man-made shelters, most probably windbreaks (Figure 9.4). All of the seven such features identified at the site occur exclusively in the Mousterian layers, most being confined to Mousterian layer IV, which has been radiocarbon-dated to between 40,200 and 44,800 BP (Păunescu 1993). The limestone blocks associated with these features often follow a linear or semicircular arrangement, but none of these features is surrounded by a complete stone ring. Most of the features also included hearths or patches of burnt soil. The animal bones that were associated with these concentrations generally come from large animals, especially mammoth, horse and rhino, but long bones and mammoth tusks are less frequent than smaller bones and molar teeth. The surface area of these features varies from approximately 2 m^2 to 40 m^2. The excavators of the site interpreted these as remains of semi-circular or circular roofless windbreaks that were built by Neanderthals to provide shelter from the eastern winds that are particularly strong in this region (Păunescu 1978, 1989b, 1993, 89; Soffer 1989). The molars of large animals, as well as the limestone blocks were likely used as weights or supports for the walls. The actual framework of the structure may have been composed of long bones, mammoth tusks, and wooden posts (Păunescu 1989b, 129, 1993, 35; Cârciumaru 1999, 77). Closer spatial analysis of these features is hampered by the fact that the site has been permanently destroyed and only part of the archaeological and faunal material was recovered during excavations and kept in storage for future analyses. Excavation reports indicate that, perhaps, not all these features were created and used in the same way. The smaller and more linear concentrations of limestone and occasional tusks may represent the remains of small and ephemeral open-sided shelters that could provide temporary working or sleeping place for one or two people. However, at least two of the identified features at Ripiceni-Izvor may have functioned as fully enclosed circular or elongated residential structures, with walls supported by wooden posts and mammoth tusks. These features are larger, have a more complex and rich inventory of artifacts and animal bones and contain a higher number of mammoth tusks and large animal bones. Similar structures were built during the Middle Palaeolithic at Chetrosu and Molodova, on the Dnestr River (Soffer 1989).

No comparable features were found in the Upper Palaeolithic (Aurignacian and Gravettian) component at Ripiceni-Izvor, and very few other Upper Palaeolithic sites in Romania yielded indications of similar or other type of man-made constructions. In the upper Aurignacian layer at Dîrţu in the Eastern Carpathians, dated to 21,000 BP, archaeologists found an oval-shaped, 7 m^2 large feature, possibly a hut, which contained a central, slightly alveolated hearth, four small cooking pits, animal bones and few artifacts (Nicolăescu-Plopşor *et al.* 1966, 71–72; Păunescu 1998, 210–212; Chirica 2001, 52). Two similar features, consisting of many lithic artifacts, bone fragments and traces of charcoal were identified in an un-dated Upper Palaeolithic layer at Pîrîul lui Istrati, near Mitoc-Malu Galben. Smaller residential structures were built during the Gravettian too, as attested by two features identified at Mitoc-Malu Galben (Chirica 2001, 51–52) and several open-air sites in the Eastern Carpathians (Păunescu 1998, 65–67). Mammoth tusks and large animal bones were either absent or infrequently utilized in these Upper Palaeolithic constructions, indicating changes in resource utilization and construction concepts.

Evidence suggests that Neanderthals were not only capable of creating artificial shelters, but they also knew how to manufacture utilitarian implements from non-lithic materials. Rudimentary bone workmanship has been reported at Middle Paleolithic cave sites in the Southern Carpathians. The Muierilor Cave at Baia de Fier, Bordul Mare Cave at Ohaba Ponor and Cioarei Cave at Boroşteni yielded fragmented bones and bone splinters, many of which show edge rounding and polish that appear to have been caused by deliberate use (Roska 1943; Nicolăescu-Plopşor 1956; Cârciumaru 1999, 99–101). Similar discoveries were made at other Romanian Middle Palaeolithic sites, but due to the unsystematic nature of the excavations and poor reporting of the findings, the context of these artifacts remains ambiguous. At Ripiceni-Izvor, fragmented and modified pieces of bone and antler, some with use-wear, were found before systematic excavations commenced at the site (Moroşan 1938). Later excavations found no indications of worked bone at the site, and with most of the early collection lost or improperly labelled (Mantu and Alexandrescu 1994), these claims are hard to corroborate. At Cioclovina Cave, excavations uncovered a large number of bone artifacts that include several pointed bone splinters with worn edges, one perforated cave bear tibia fragment and four perforated cave bear canines. These artifacts were found in a layer that contained both Middle and the early Upper Palaeolithic material (Roska 1912). Igriţa Cave, in Transylvania, yielded an even more impressive collection of simple bone artifacts, mostly points and borers. Here, excavations brought to light a small assemblage of Middle and Upper Paleolithic tools made of white quartzite (Roska 1926, 1931b; Bitiri 1965a, 11; Boroneanţ 2000, 6–7). In western Romania, two other cave sites, Popovaci and Cerbului (formerly Szarvasbarlang) yielded a rich assemblage of modified bone artifacts, perforated cave bear teeth and an incised piece of bone (Balogh 1942). The latter two sites are thought to date to the early Upper Paleolithic (Aurignacian), but at Cerbului Cave the organic artifacts were found in association with a Mousterian point made out of quartzite (Balogh 1942, 12–14; Cârciumaru 1999, 10). These discoveries indicate that simple bone workmanship was relatively common at sites used by Neanderthal, especially at locations where good quality lithic raw material was sparse.

Compared to Middle Palaeolithic sites, assemblages dated to the early Upper Palaeolithic contain fewer bone artifacts, but the execution of these was superior relative to those made during the Middle Paleolithic. Split-based bone points are missing in the Romanian Paleolithic, but Mladec-type points were found at Baia de Fier (Allsworth-Jones 1986, 214; Păunescu 1996, 195) and Mitoc-Malu Galben

(Chirica *et al.* 1996a, 87; Păunescu 1996, 194; Chirica 2001, 93). Non-diagnostic bone points were recovered in an Aurignacian context at Igriţa (Roska 1931b, 119; Păunescu 1996, 196), Bistricioara-Lutărie (Păunescu 1998, 129–130; Beldiman 2000), Mitoc-Valea Izvorului (Bitiri and Cârciumaru 1981, 6; Cârciumaru 1999, 116; Păunescu 1999a, 134), and Stînca Ripiceni Rockshelter (Păunescu 1996, 195, 1999a, 164–165). In addition to a bone point tip, the latter site yielded close to twenty artifacts made out of bone and teeth, making this the largest known Aurignacian collection of organic artifacts in Romania. As on the Russian Plain, a true proliferation of bone workmanship took place during the Gravettian, as revealed by an impressive number of artifacts made out of bone, antler and teeth that were discovered at several different locations, on the Prut River (Cotu Miculinţ, Crasnaleuca and Stînca Ripiceni), in the Southern Carpathians (Boroşteni and Gura-Cheii Rîşnov), and the Eastern Carpathians (Poiana Cireşului) (Borziac 1994; Păunescu 1996, 1999a; Cârciumaru 1999, 168–169, 2000, 173–177; Cârciumaru *et al.* 2004).

Artifacts that have a non-utilitarian purpose are rare at both Middle Palaeolithic and early Upper Palaeolithic sites. With the possible exception of the perforated long bone and modified teeth from Cioclovina Cave, deliberately crafted artifacts of artistic value are missing in the Romanian Middle Palaeolithic. Non-utilitarian bone artifacts remain infrequent during the early Upper Palaeolithic. Few perforated animal teeth have been reported from the early Upper Palaeolithic (Aurignacian) layers at Bordul-Mare, Gura Cheii-Rîşnov and Cerbului (Szarvasbarlang) Caves in the Carpathians, but the context of these finds has been disputed (Balogh 1942; Cârciumaru 1999, 165). Perforated teeth, as well as incised and perforated bone and stone artifacts become more common during the Gravettian. Ochre is, however, well documented at Middle Palaeolithic sites. At Cioarei Cave in the Southern Carpathians excavations uncovered large quantities of ochre and eight small ochre grinding containers in the Mousterian layers (Cârciumaru *et al.* 1999). Ochre is also present in the Upper Palaeolithic layers at the site, but in smaller quantities, and ochre processing implements are missing in these layers. The purpose of early pigment utilization remains unknown at Cioarei Cave, but later evidence suggests that the use of red pigment has assumed a symbolic role, as it appears on an incised stone pendant found in the Gravettian layer at this site (Cârciumaru 2000, 173–177). Claims for pigment use during the Middle Palaeolithic have surfaced at Ripiceni-Izvor as well, (Moroşan 1938, 41; Păunescu 1993, 130), but these were not confirmed by later excavations.

There are some reports of Palaeolithic cave art in Romania, but the context of these findings remains unclear. At Cuciulat Cave in northwestern Romania, the poorly preserved contours of a human figure, a horse, and a feline were identified in 1978 (Cârciumaru and Bitiri 1979, 1980; Bitiri and Cârciumaru 1980). It has been suggested that these representations were made during the Upper Palaeolithic, but there is no archaeological material in this cave that can be securely dated to the Palaeolithic (Cârciumaru 1999, 171–174). The cave was used by post-Palaeolithic people and some believe that the parietal art can be more securely linked to the Mesolithic occupation of this site (Boroneanţ 2000, 91). A more contentious claim for Palaeolithic cave art in Romania comes from Cioclovina Cave. According to observations and photographs made almost 100 years ago, a small section of the cave wall, located next to the largest concentration of archaeological remains had a series of randomly made engraved lines (Roska 1923). In this case, Middle and Upper Palaeolithic occupation is clearly attested to by the presence of artifacts and hominid remains, but the anthropogenic origin of these representations has not been firmly established or proved by later research and some believe that the lines were the work of denning animals (Boroneanţ 2000, 75). As with the rest of the archaeological deposit in this cave, subsequent mining operations destroyed the section of the wall where this possible 'art' was identified.

This summary illustrates that the different components of human behaviour changed at different rates during the Middle to Upper Palaeolithic transition. The archaeological record does not support the idea of a sudden behavioural explosion or change at the time when Upper Palaeolithic technologies first emerged in Romania. Some of the changes that are visible archaeologically originated in the Mousterian context, while others emerged only during the later Upper Palaeolithic. This indicates that, in many ways, Neanderthals developed successful adaptations that were not inferior to those of later Upper Palaeolithic groups. Some of these adaptations came to an end at the onset of the Upper Palaeolithic, while others underwent a gradual transformation. The archaeologically most visible changes that the Upper Palaeolithic brought to this region are related to a much greater degree of mobility and a more successful acquisition and utilization of resources.

Middle and Upper Palaeolithic hominid discoveries in Romania

Late Middle and early Upper Palaeolithic sites in Romania yielded a small collection of Neanderthal remains and a larger number of specimens that can be attributed to *Homo sapiens sapiens*. While discussions persist on the cultural context of some of these findings, Neanderthal skeletal remains are generally associated with Middle Palaeolithic assemblages, while those described as modern humans were found in Upper Palaeolithic context, with the possible exception of Peştera Cave and Muierilor Cave at Baia de Fier (Table 9.2).

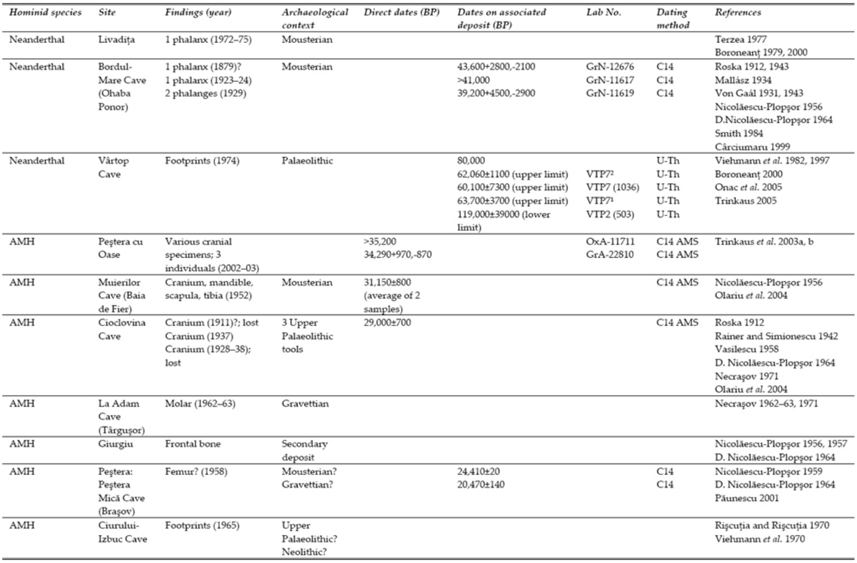
The two sites that yielded bones of Neanderthals are Bordul Mare at Ohaba Ponor and Livadiţa, both cave sites in the Southern Carpathians. In the latter, excavations conducted between 1972 and 1975 uncovered a single Palaeolithic (Mousterian) component, a rich collection of faunal remains and one phalanx attributed to a Neanderthal individual (Terzea 1977; Boroneanţ 1979, 2000, 20; Cârciumaru 1999, 70). Ohaba Ponor is a multi-component Palaeolithic site, with four Mousterian and one Upper Palaeolithic (Aurignacian) layers (Nicolăescu-Plopşor 1957; Boroneanţ 2000, 80–81). Unfortunately, all hominid discoveries were made in this cave prior to the beginning of more systematic excavations that commenced in the 1950s. The earliest, unauthenticated discovery (1 hominid phalanx) was made and reported in 1879 by Zsófia Torma (in Roska 1912, 34). Later, Mallász uncovered one foot phalanx during the 1923–24 excavations, while two hand phalanges were found in 1929 by Roska (Mallász 1934; von Gaál 1943; Jungbert 1982, 547–549), all of which were assigned to Neanderthals (von Gaál 1931, 1943; Nicolăescu-Plopşor 1956; Smith 1984, 167). This contradicts an alternative interpretation proposed by the anthropologist D. Nicolăescu-Plopşor (1964, 384), who attributes the phalanges from Ohaba Ponor to *Homo sapiens sapiens*, and draws parallels between this site and Baia de Fier, where modern human remains were discovered in deposits that contain primarily Mousterian artifacts. Inconsistencies in the numbering of the archaeological layers at Ohaba Ponor, led to controversies regarding the exact location of the hominid remains (Necraşov 1971, 156; Chirica *et al.* 1996a, 143). A corroboration of the available accounts suggests that all three hominid remains were found in the second youngest Mousterian layer, now referred to as Mousterian III (von Gaál 1943; Roska 1943; Jungbert 1982; Allsworth-Jones 1986, 207), which is chronometrically dated between 43,600 and 39,200 BP (Cârciumaru 1999, 205–206).

As many as six Paleolithic sites in Romania yielded remains of *Homo sapiens sapiens*. Direct dates have been published so far for hominids found at three of these sites, and these dates indicate that the earliest moderns were present in Romania between 29,000 and 35,000 BP. As with Neanderthal remains, the majority of modern human findings originate in the Southern Carpathians, albeit isolated hominid sites are found in every geographic region of the country and a variety of settings, both caves and open-air sites. The greater visibility and larger geographic spread of modern human remains implies larger population size and more diverse adaptations during the Upper Palaeolithic.

The earliest anatomically modern humans in Romania come from the most recently discovered hominid site, Peştera cu Oase, in the western foothills of the Southern Carpathians (the exact location of this site has not yet been published, but it is claimed to be different from a known post-Palaeolihic site in the region that has the same name). Cranial fragments, including a mandible, a cranium with most of the facial region, as well as a separate temporal bone indicate the presence of at least three individuals, all assigned to *Homo sapiens sapiens* (Trinkaus *et al.* 2003a and 2003b). These remains represent large early modern humans, with some archaic traits, such as large faces, wide cheekbones and palates, flaring mandibular *rami* and robust posterior molars (Trinkaus *et al.* 2003a). Direct AMS dates provided a finite age of 34,950, + 990,-890 BP for the mandible at Peştera cu Oase (Trinkaus *et al.* 2003a, 2003b).

Following the discovery and dating of the Peştera cu Oase remains, two other modern human sites yielded direct dates on hominid bones (Olariu *et al.* 2004). In both cases, the dated hominid material comes from old excavations. One of these sites is Muierilor Cave in the Southern Carpathians that was excavated between 1951 and 1955 (Nicolăescu-Plopşor 1956). Two Mousterian and a smaller Upper Palaeolithic (Aurignacian) layer were identified in this cave, and while the Upper Palaeolithic component appears to concentrate near the entrance of the cave, some mixture of Middle and Upper Palaeolithic material was evident inside the cave (Nicolăescu-Plopşor *et al.* 1957; Allsworth-Jones 1986, 214; Olariu *et al.* 2004). A nearly complete cranium, a fragment of a mandible, a scapula and a tibia, all assigned to *Homo sapiens sapiens* were found in 1952, in a section of the cave known as Gallery M, where excavations uncovered only Middle Palaeolithic material (Nicolăescu-Plopşor 1956; D. Nicolăescu-Plopşor 1964; Necraşov 1971; Chirica *et al.* 1996a, 139–141). The hominid findings surfaced from the upper archaeological layer, which contained typical Mousterian quartzite tools, one fragmented flint blade, some fragmented bones that appear to have been worked, and a collection of cold-adapted faunal species. Direct AMS dates were obtained on bone samples extracted from the scapula and the tibia and these yielded a combined age of 30,150 ± 800 BP (Olariu *et al.* 2004). These dates confirmed the authenticity and early Upper Palaeolithic age of the Muierilor modern humans, but they leave important questions regarding the association between the human bones and the archaeological material. One possibility is that the moderns used a Middle Palaeolithic technology and can be directly associated with the Mousterian layer. Alternatively, the modern human remains may have become separated from their original Upper Palaeolithic context and mixed in with the Mousterian material.

Table 9.2. Late Middle Palaeolithic and early Upper Palaeolithic hominid findings in Romania.



Hominid species	*Site*	*Findings (year)*	*Archaeological context*	*Direct dates (BP)*	*Dates on associated deposit (BP)*	*Lab No.*	*Dating method*	*References*
Neanderthal	Livadiţa	1 phalanx (1972–75)	Mousterian					Terzea 1977 Boroneanţ 1979, 2000
Neanderthal	Bordul-Mare Cave (Ohaba Ponor)	1 phalanx (1879)? 1 phalanx (1923–24) 2 phalanges (1929)	Mousterian		43,600+2800,-2100 >41,000 39,200+4500,-2900	GrN-12676 GrN-11617 GrN-11619	C14 C14 C14	Roska 1912, 1943 Mallász 1934 Von Gaál 1931, 1943 Nicolăescu-Plopşor 1956 D.Nicolăescu-Plopşor 1964 Smith 1984 Cârciumaru 1999
Neanderthal	Vârtop Cave	Footprints (1974)	Palaeolithic		80,000 62,060±1100 (upper limit) 60,100±7300 (upper limit) 63,700±3700 (upper limit) 119,000±39000 (lower limit)	 VTP7^2 VTP7 (1036) VTP7^1 VTP2 (503)	U-Th U-Th U-Th U-Th U-Th	Viehmann *et al.* 1982, 1997 Boroneanţ 2000 Onac *et al.* 2005 Trinkaus 2005
AMH	Peştera cu Oase	Various cranial specimens; 3 individuals (2002–03)		>35,200 34,290+970,-870		OxA-11711 GrA-22810	C14 AMS C14 AMS	Trinkaus *et al.* 2003a, b
AMH	Muierilor Cave (Baia de Fier)	Cranium, mandible, scapula, tibia (1952)	Mousterian	31,150±800 (average of 2 samples)			C14 AMS	Nicolăescu-Plopşor 1956 Olariu *et al.* 2004
AMH	Cioclovina Cave	Cranium (1911)?; lost Cranium (1937) Cranium (1928–38); lost	3 Upper Palaeolithic tools	29,000±700			C14 AMS	Roska 1912 Rainer and Simionescu 1942 Vasilescu 1958 D. Nicolăescu-Plopşor 1964 Necraşov 1971 Olariu *et al.* 2004
AMH	La Adam Cave (Târguşor)	Molar (1962–63)	Gravettian					Necraşov 1962–63, 1971
AMH	Giurgiu	Frontal bone	Secondary deposit					Nicolăescu-Plopşor 1956, 1957 D. Nicolăescu-Plopşor 1964
AMH	Peştera: Peştera Mică Cave (Braşov)	Femur? (1958)	Mousterian? Gravettian?		24,410±20 20,470±140		C14 C14	Nicolăescu-Plopşor 1959 D. Nicolăescu-Plopşor 1964 Păunescu 2001
AMH	Ciurului-Izbuc Cave	Footprints (1965)	Upper Palaeolithic? Neolithic?					Rişcuţia and Rişcuţia 1970 Viehmann *et al.* 1970

The other directly dated hominid site is Cioclovina Cave. This is also a multi-component Middle and Upper Palaeolithic site, but unlike Muierilor Cave, archaeological excavations were less systematic at this site and all hominid discoveries were made by nonprofessionals, either during amateur explorations of the cave or over the course of mining operations. This site was intermittently excavated between 1911 and 1927 (Roska 1912, 1923, 1926, 1931a, 1933), after which extensive guano mining operations took over, which led to the removal of almost the entire deposit from the inside of the cave (Vasilescu 1958). The literature commonly makes reference to one hominid find from Cioclovina, an adult cranium of a *Homo sapiens sapiens*, found by a guano miner in 1937 inside the cave, which after a perilous journey arrived several years later to the Faculty of Geology of the University of Bucharest (Rainer and Simionescu 1942; Vasilescu 1958; Necraşov 1971). The authenticity of the find is attested to by traces of the original reddish-yellow clay matrix that were found still adhering to the bones when they arrived to Bucharest. This modern human cranium was recently dated directly with AMS to 29,000 ± 700 BP (Olariu *et al.* 2004). According to accounts provided by the workmen who spotted the skull, this was found in association with three lithic implements, two retouched blades and a nondiagnostic piece, two of which are made out of flint, and one of opal (Rainer and Simionescu 1942). The choice of raw materials and the morphology of the artifacts have been assumed to indicate affiliations with the Upper Palaeolithic component at the site, but because of the special conditions of discovery, the exact association between the hominid remains and the archaeological material will remain unknown. In addition to this specimen, Cioclovina yielded at least two other crania, the fate of which was less fortunate. The earliest hominid discovery was made prior to the start of excavations in 1911. Roska (1912) was shown the location of the discovery, but neither he nor other specialists were allowed access to this find. Another cranium was reportedly found in this cave during the decade when guano mining took place at the site (1928–1938). According to reports, this cranium was spotted and removed by miners, but it became lost during transportation (D. Nicolăescu-Plopşor 1964, 384).

Isolated dental and skeletal remains of modern humans were found at three other sites in Romania. At La Adam cave, a deeply stratified Middle and Upper Palaeolithic site near Târguşor in Dobrogea, a hominid molar was recovered in a microlithic Upper Palaeolithic layer that is assigned to the Gravettian (Păunescu 1989, 145, 1999b, 208; Cârciumaru 1999, 127). Necraşov (1962–63, 1971) determined this to belong to a *Homo sapiens sapiens* child, but identified some archaic traits on the specimen. While this site is one of the most extensively excavated and better-known archaeological sites in Dobrogea, no chronometric dates are available for either the archaeological deposits or the hominid material. The Gravettian is generally known to have developed late in this part of the country, persisting until 13,000–12,000 BP (Păunescu 1999b, 48). A heavily rolled and fossilized frontal bone was found in the vicinity of the city of Giurgiu on the Danube. The discovery was made by construction workers during a bridge building operation, at a depth of 20 meters from the surface (Cârciumaru 1999, 126). Signs of extensive rolling on the specimen suggest that the bone was found in a secondary deposit. While attributed to *Homo sapiens sapiens* (Nicolăescu-Plopşor 1956, 1957, 57; D. Nicolăescu-Plopşor 1964, 385), the frontal bone exhibits a number of archaic features, such as a wide inter-orbital region, well-developed brow ridges and a low and sloping forehead (D. Nicolăescu-Plopşor 1964, 385; Cârciumaru 1999, Figure 71:3). The middle and late Aurignacian is well documented at the nearby Giurgiu-Malu Roşu site (Alexandrescu 1996–1998; Chirica *et al.* 1996b; Alexandrescu and Popa 1999–2000), but because of the depositional and recovery conditions, the chronological context and the archaeological association of this specimen remain unknown.

Modern human remains were also reported at Peştera Cave, near the city of Braşov in central Romania. At this site, the anthropologist D. Nicolăescu-Plopşor (1964, 385) makes a brief reference to a fragment of a modern human femur that was found in the upper Mousterian component. The authenticity of this find and the proposed identification were later questioned, as the claims are not substantiated by the original excavation reports and later publications on this site. This cave site is part of a complex composed of three different caves. All three were excavated in the 1950s and they yielded late Middle Palaeolithic and Upper Palaeolithic material. At one of these caves, Peştera Mică, the excavators make reference to one 'small fossil human specimen' (Nicolăescu-Plopşor 1959). While it is possible that this note refers to the 'Peştera femur' mentioned by D. Nicolăescu-

Plopşor (Jungbert 1982, 552), palaeontological mis-identification or mis-reporting cannot be excluded (Cârciumaru 1999, 69–70). D. Nicolăescu-Plopşor (1964) was particularly accepting of the view that modern humans (at Baia de Fier and Ohaba Ponor) were responsible for the late Mousterian in the Southern Carpathians and this bias may have played a role in him potentially mis-reporting this discovery. No independent taxonomic identification is available for this specimen. Archaeological excavations reopened in Peştera Mică Cave in 1998 and these excavations found exclusively Aurignacian and Gravettian material. It has been suggested that the possible hominid femur originally came from the Gravettian component, which has been dated at this site to between 24,400 and 20,400 BP (Păunescu 2001, 330–332). Another unconfirmed hominid discovery comes from Mitoc-Malu Galben. According to one report, the upper Aurignacian deposit yielded two incisors that may belong to a hominid (Honea 1987, 54). No other reference or positive identification is available for these specimens, and these are now considered lost (Chirica, personal communication 2004).

Indirect evidence for human presence at Palaeolithic sites in Romania has been provided by footprints preserved on cave floors. Two such sites were identified, both in Transylvania, but very little is known about their archaeological context. In both cases, the footprints are considered to be authentic and are well supported by documentary evidence, such as photographs, casts and some originals removed. At Ciurului-Izbuc Cave, an entire series of human footprints, mixed in with cave bear prints was discovered in 1965 (Rişcuţia and Rişcuţia 1970; Boroneanţ 2000, 1). These are thought to belong to at least three individuals, a taller person, most likely a man, a woman and an older child (Păunescu 1989a, 145). According to some, these footprints were made by early moderns who posessed some Neanderthal traits (Păunescu 1989a, 145; Cârciumaru 1999, 127–128), while others attribute both the footprints and the archaeological material in this cave to the Neolithic (Boroneanţ 2000, 1). Hominid footprints were also detected inside Vârtop Cave (Viehmann *et al.* 1982). The site has been published as a Palaeolithic, possibly pre-Mousterian site (Boroneanţ 2000, 2), but no systematic excavations have yet been completed at this location. Unlike the footprints from Ciurului-Izbuc, those from Vârtop are much wider, shorter and appear to be non-modern. A series of U-Th dates obtained on cave deposits directly associated with the footprints indicate an age between 97,000 and 62,000 BP (Viehmann *et al.* 1997; Onac *et al.* 2005). The available dates and the morphology of the footprints from Vârtop suggest that these belong to a Neanderthal individual (Onac *et al.* 2005; Trinkaus 2005). Further research is needed at both of these sites to better understand the archaeological and chronological context of human presence at these hominid localities in Romania.

Conclusions

The period between 50,000 and 30,000 BP was marked in the Romanian Palaeolithic by a series of changes in human culture and adaptation. True early Upper Palaeolithic cultures emerged during this time and these appear to have ties to the central and southeast European Aurignacian. This development did not mark, however the end of the Middle Palaeolithic traditions in Romania. The Brynzenian, the Mitoc-facies early Upper Palaeolithic, the Prut culture, the Szeletian and Corpaci-facies early Upper Palaeolithic are all archaeologically defined entities that share one common characteristic: they all integrate some Mousterian elements. As noted by others (Noiret 2004), these different industries persisted side-by-side with the Aurignacian in the region and this co-existence reflects the presence of multiple evolutionary lines in the Romanian early Upper Palaeolithic. Some of these lines originate in the local Mousterian, and others appear to have been driven by population movements and changes from the outside.

Almost the entire research on this topic is based on lithic typologies. These typologies have helped specialists define distinct archaeological units or industries, but they also created a true taxonomic quagmire and a lot of ambiguity with respect to the characterization and definition of these industries. From a typological perspective, there is a great degree of overlap between the different transitional or early Upper Palaeolithic industries discussed in this paper, and debates on which assemblage should fall under one industry and what are the exact parameters that distinguish one industry from another seem to be incessant. The use of lithic types tends to generate a more conservative assemblage characterization, but this problem may be rectified by using technological and use-wear analyses. Technological research in northeastern Romania revealed that during the early Upper Palaeolithic, tool-making methods underwent more change than lithic types, but it is more likely that the latter are not methodologically apt to correctly characterizing archaeological assemblages.

It is hoped that future research in the Romanian early Upper Palaeolithic will take greater advantage of the variety of existing research methods and will attempt to broaden the scope of research while relying on more inter-site and inter-regional comparisons. A regional synthesis of early Upper Palaeolithic behavioural changes is still in its infancy, not because of scarcity of data, but because, very often, the data and archaeological material are hard to access. Behavioural changes did not progress uniformly during the early Upper Palaeolithic. In basic adaptation, resource utilization, the organization of living space and the use of alternative raw materials Neanderthal groups in Romania did not fare more poorly than Upper Palaeolithic people. The latter had the advantage in environmental knowledge, adaptability, mobility, larger-scale social networking and artistic ingenuity.

There is no evidence for rapid population replacement in Romania. Anatomically modern humans coexisted for several millennia with groups who used Mousterian technologies. The interaction between Neanderthals and moderns, as well as the association between different hominid groups and archaeological cultures remains to be clarified by future research. Archaeologically, the Middle Palaeolithic disappeared slowly and gradually in Romania, and it appears that early Upper Palaeolithic industries with transitional characteristics helped perpetuate Mousterian traditions well into the Upper Palaeolithic. It is hoped that with a continued interest in the Romanian Palaeolithic and easy access to new and old findings these questions will become better answered in the future for both Romanian and foreign archaeologists.

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10. Adriatic Coast of Croatia and its hinterland from 50 000 to 25 000 BP

Ivor Karavanić

Abstract

This paper presents the recent analysis of the lithic artifacts from the upper layers (containing a late Mousterian industry) from the site of Mujina Pećina, Dalmatia and the Aurignacian levels of the site of Šandalja II, Istria. Mousterian tools from Mujina Pećina are predominantly produced on local chert, with the occasional use of Levallois technology. Local chert is also predominant in the Aurignacian of Šandalja II where blades are produced using soft hammer percussion. Although in the Mousterian sequence of Mujina Pećina some Upper Paleolithic tool types are present, and in the Aurignacian levels of the Šandalja II Middle Paleolithic tool types are numerous, neither industry shows a progressive transitional nature. Furthermore, no site in the eastern Adriatic region thus far documents the Middle/Upper Paleolithic transition and Aurignacian sites on the Adriatic coast of Croatia are very rare. Possible explanations include the rise of the sea level at the end of the Pleistocene, the lack of research/systematic survey in the region for sites of these periods and/or the low population density in this region during the Aurignacian.

Introduction

The sites of Croatia are known worldwide in archaeology and paleoanthropology because of important finds of fossil hominins and/or their material cultures. The most famous and well studied sites are the Middle Paleolithic site of Krapina and the Middle and Upper Paleolithic site of Vindija, located in the continental part of Croatia. In contrast, Middle and early Upper Paleolithic sites from the Adriatic region of Croatia are not well known. This paper presents results of the lithic analysis of the two sites from the Adriatic region of Croatia. These are the sites of Mujina Pećina, located in Dalmatia, and Šandalja II located on the Istrian peninsula (Figure 10.1). The Mousterian industry from the upper and middle levels of the former site have been analysed as well as the Aurignacian industry from four stratigraphic units of the latter site. Results of the lithic analysis are presented in more detail than in previous publications (Rink *et al.* 2002; Karavanić 2007), and in a wider context of the Middle/Upper Paleolithic interface of the eastern Adriatic coast.

Sites

Mujina Pećina

Mujina Pećina is situated in Dalmatia, north of Trogir and west of Split, in typical karstic terrain (Figure 10.2). It is approximately 10 m long and 8 m wide and it is located at about 260 m above sea level. The initial finds were collected in 1977 from the surface of the cave and from deposits in front of its entrance (Malez 1979) and the first test excavations were done in 1977 (Petrić 1979). The systematic excavations were carried out by the Department of Archaeology of the University of Zagreb and by the Kaštela City Museum between 1995 and 2004 (Figure 10.3). All artifacts and ecofacts of 2 cm or more in size were recorded in three dimensions on site plans, and all sediments were sieved.

Description of the levels published in previous papers was based on the North profile «A» (Karavanić and Bilich-Kamenjarin 1997; Rink *et al.* 2002). This profile was exposed during the first season of systematic excavations in 1995, when test excavations were limited to only two square metres. In the following field seasons, the excavated space was vastly englarged, covering 24 square metres, mainly in the right half of the cave. During the last years of excavations, a part of the area at the cave entrance was also excavated.

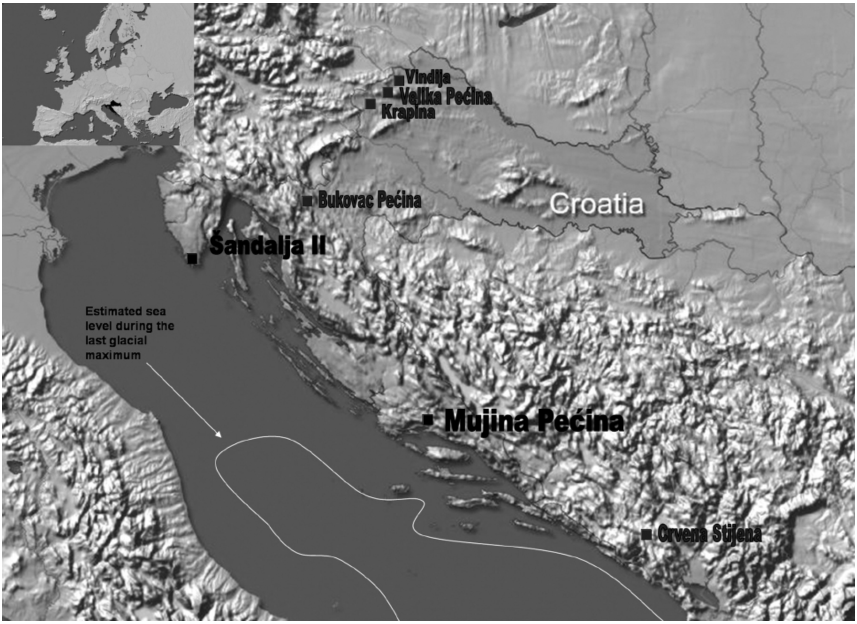


Figure 10.1. Important Middle and early Upper Paleolithic sites of continental Croatia and Eastern Adriatic region.

The main stratigraphic profile in the cave (profile «A») is only about 1.5 m deep (Figure 10.4). It is comprised of poorly sorted Quaternary sediments composed of large fragments of carbonate rock (debris), gravel and sand grains, some silt, and some clay (see Karavanić and Bilich-Kamenjarin 1997; Rink *et al.* 2002). Layers contain Mousterian lithics and faunal remains. Except for level E3 (which appears mostly above the cave floor at the entrance, but which cannot be observed in profile «A») and level C (present only in one part of the cave), the features of the various levels in the cave are mostly the same in all of the excavated areas, except for the varying layer thickness.

Electron spin resonance (ESR) dating was conducted on two teeth from Mousterian level E1 at Mujina Pećina, while one charcoal and five bone samples coming from five different strata were dated by AMS ^{14}C (Rink *et al.* 2002). For level E1, mean ESR age estimates of 40 ± 7 ka (EU) and 44 ± 5 ka (LU) have been obtained (assuming 30% moisture for both the gamma and beta dose rate calculations). The interface between Levels E2 and E1 has been dated by AMS ^{14}C to 45 ka BP (Rink *et al.* 2002). Four out of five dates for overlying levels, obtained on bone samples, are consistent with each other, while the charcoal date is much younger and does not fit chronologically into the sequence. Contamination of the sample was not observed, however, so the result of the charcoal sample was included in the calculation of the age as the mean of five dates from overlying levels. The AMS ^{14}C age of these levels (D2, D1, C and B), calculated as the mean of five dates from these levels, is about 39 ka BP, with the true (calibrated) age of this mean age being about 42 ka (Rink *et al.* 2002), based on the calibration curves of Bard *et al.* (1990). These dates suggest that the entire Mujina Pećina stratigraphic profile «A» was very rapidly deposited during oxygen isotope stage 3 and they indicate that the radiocarbon results are in close agreement with the ESR ages calculated at 30% moisture (Rink *et al.* 2002). These results provided the first chronometric dates for the Mousterian in Dalmatia, providing a chronological anchor for the Mousterian in the Eastern Adriatic region.

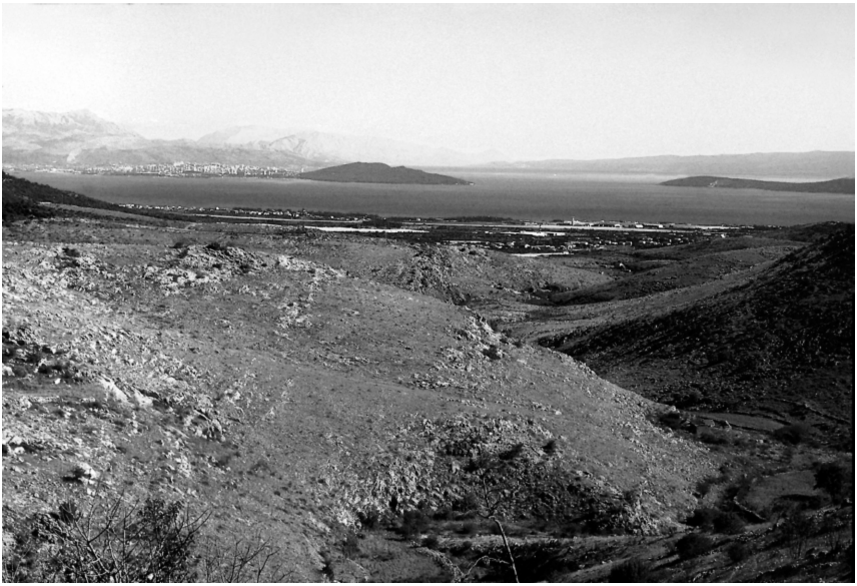


Figure 10.2. View from the area in front of Mujina Pećina. The landscape is marked by hilly terrain and the Kaštela Bay, which was dry land in the late Middle Paleolithic when the cave was occupied. Photo taken by I. Karavanić.

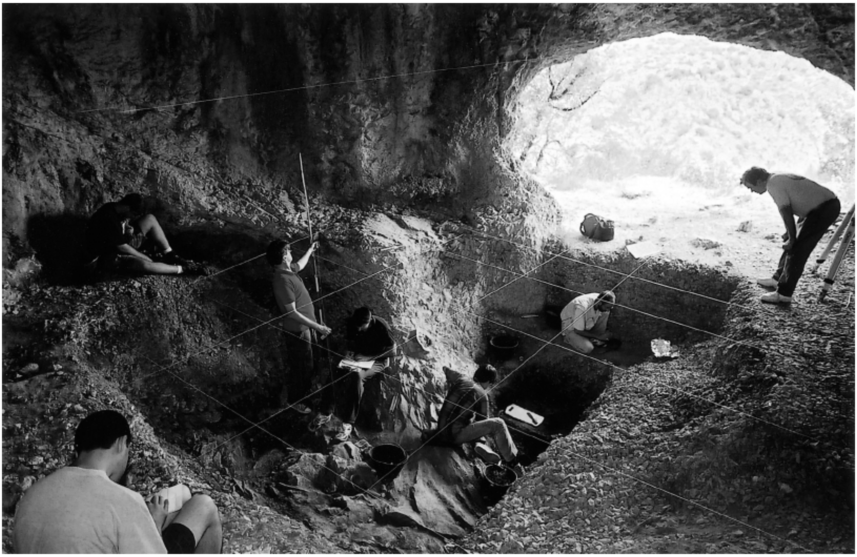
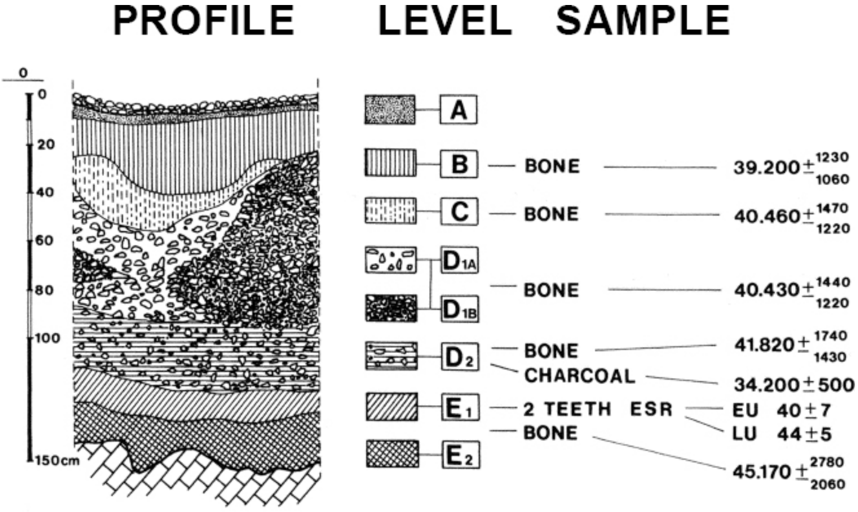


Figure 10.3. Excavating in Mujina Pećina. Bedrock is visible in excavated squares in the middle of the cave. Photo taken by S. Burić.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BONE — 40.430 +1440 −1220
D2 — BONE — 41.820 +1740 −1430
CHARCOAL — 34.200 ± 500
E1 — 2 TEETH ESR — EU 40 ± 7
LU 44 ± 5
BONE — 45.170 +2780 −2060
E2

Figure 10.4. Stratigraphic profile of Mujina Pećina (modified after Rink et al. 2002, Figure 3).

Based on the fetal and neonatal faunal remains, Preston Miracle of the University of Cambridge was able to establish the exact seasons during which some of the occupations occurred (Miracle 2005). During the accumulation of level B, most of the human occupation episodes took place in fall and possibly in spring. Spring episodes are also likely during the formation of level D1. People were not present at the site during summer or winter, when the cave served as a bear den.

Lithic analysis has been done for layers D2, D1, C and B in which findings are less numerous than in the lower layers (E1 and E2), the analysis of which is still in progress. Analyzed finds are from excavations carried out between 1995 and 2000, while later finds from the cave entrance are not included. Due to the low number of items in the individual layers, and the similarity of their lithic assemblages, layers D2 and D1 on one hand, and C and B on the other, were treated as single units.

Technological analysis of the Mujina Pećina material was done using the modified list of technological types developed by Jean-Michel Geneste (1988) for the Mousterian industry of Vaufrey cave (Dordogne, France). This list, modified for the Mujina Pećina material, contains 25 categories, showing the different phases of production (Table 10.1).

Category 0 indicates locating and obtaining raw material. For categories 1–8, complete pieces, as well as fragments with and without bulb of percussion, are included. Category 1 indicates initial phase of production. Categories 2–19 represent the next phase of production, which involve the formation of secondary decortication and regular flakes (without cortex), blades and Levallois points. Categories 2–10 represent items knapped from different cores (different flakes and blades). Categories 11–17 represent various types of cores while categories 18 and 19 are specific products of core preparation or rejuvenation. Category 20 represents the final phase of reduction – retouching of tools. Categories 21–24 can be part of any of the phases in the reduction sequence, and thus cannot be classified like the other categories.

Tools are divided into 6 mayor types: 1. Mousterian points, 2. sidescrapers, 3. denticulates, notched pieces and becs, 4. retouched flakes, 5. Upper Palaeolithic types, 6. various (Table 10.2).

The majority of rocks (cherts) used for knapping can be found in the environs of the cave, while some pieces could have been transported from more distant locations (30–40 km). The uppermost level A (the thin humus layer) consists of a mixture of Mousterian artifacts and animal bones with recent waste. Levels B and C contain a total of 403 stone artifacts. Of those, 131 pieces (32.5%) represent tools, while levels D1 and D2 contain a stone assemblage of 222 pieces, of which 47 pieces (21. 2%) are tools.

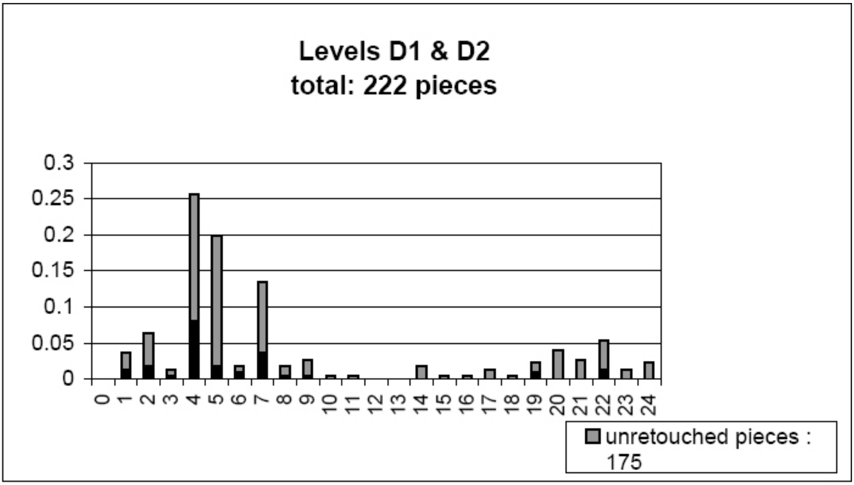
Regular flakes are most abundant, while small flakes (which are 2 cm or less in size) are also very common (Table 10.1 and Figure 10.5). Levallois-type debitage is more abundant in layers D2 and D1 than in layers C and B. The two small Levallois cores that have been found in layers B and D2 show that the use of this method has been skillfully applied on the small-sized local chert pebbles. This might suggest a high degree of adaptibility of Mujina Pećina Mousterian people. Chunks are numerous in layers B and C, which might be explained by the characteristics of the local cherts, which break irregularly.

Table 10.1. The quantity and the percentage of the technological categories of Mujina Pećina.

	Technological category	*Levels B and C*				*Levels D1 and D2*			
		retouched pieces		unretouched pieces		retouched pieces		unretouched pieces	
		quantity	%	quantity	%	quantity	%	quantity	%
0	nodule or pebble	0	0.00%	1	0.25%	0	0.00%	0	0.00%
1	primary decorication flake (more than 50% of cortex)	8	1.99%	3	0.74%	3	1.35%	5	2.25%
2	secondary decortication flake (50% or less of cortex)	21	5.21%	16	3.97%	4	1.80%	10	4.51%
3	naturally backed knife	1	0.25%	1	0.25%	1	0.45%	2	0.90%
4	flake	55	13.65%	56	13.90%	18	8.11%	39	17.57%
5	small flake (2 cm or less in size)	10	2.48%	42	10.42%	4	1.80%	40	18.02%
6	blade	5	1.24%	1	0.25%	2	0.90%	2	0.90%
7	levallois flake	7	1.74%	14	3.47%	8	3.60%	22	9.91%
8	levallois blade	2	0.50%	0	0.00%	1	0.45%	3	1.35%
9	levallois point	3	0.74%	1	0.25%	1	0.45%	5	2.25%
10	pseudolevallois point	0	0.00%	0	0.00%	0	0.00%	1	0.45%
11	polyhedral	0	0.00%	1	0.25%	0	0.00%	1	0.45%
12	discoid core	0	0.00%	1	0.25%	0	0.00%	0	0.00%
13	flake core with cortex	0	0.00%	9	2.23%	0	0.00%	0	0.00%
14	flake core without cortex	0	0.00%	12	2.98%	0	0.00%	4	1.80%
15	levallois core	1	0.25%	1	0.25%	0	0.00%	1	0.45%
16	core fragment with cortex	1	0.25%	3	0.74%	0	0.00%	1	0.45%
17	core fragment without cortex	0	0.00%	7	1.74%	0	0.00%	3	1.35%
18	crested flake	0	0.00%	1	0.25%	0	0.00%	1	0.45%
19	core renewal flake	0	0.00%	3	0.74%	2	0.90%	3	1.35%
20	retouch flake	0	0.00%	15	3.72%	0	0.00%	9	4.05%
21	chunk with cortex	3	0.74%	20	4.96%	0	0.00%	6	2.70%
22	chunk without cortex	12	2.98%	41	10.17%	3	1.35%	9	4.05%
23	shatter (1 cm or less in size)	0	0.00%	13	3.23%	0	0.00%	3	1.35%
24	unidentifiable fragments	2	0.50%	10	2.48%	0	0.00%	5	2.25%
	Total	131	32.51%	272	67.49%	47	21.17%	175	78.83%

Table 10.2. The quantity and the percentage of main tool types of Mujina Pećina.

tool type	*levels B & C*		*levels D1 & D2*	
	quantity	%	quantity	%
1. Mousterian point	0	0.00%	1	2.13%
2. sidescraper	16	12.21%	5	10.64%
3. denticulates and notched pieces	52	39.70%	14	29.79%
4. retouched flake	36	27.48%	19	40.43%
5. Upper Paleolitihc types	20	15.27%	5	10.64%
6. various	7	5.34%	3	6.38%
Total	131	100.00%	47	100.00%



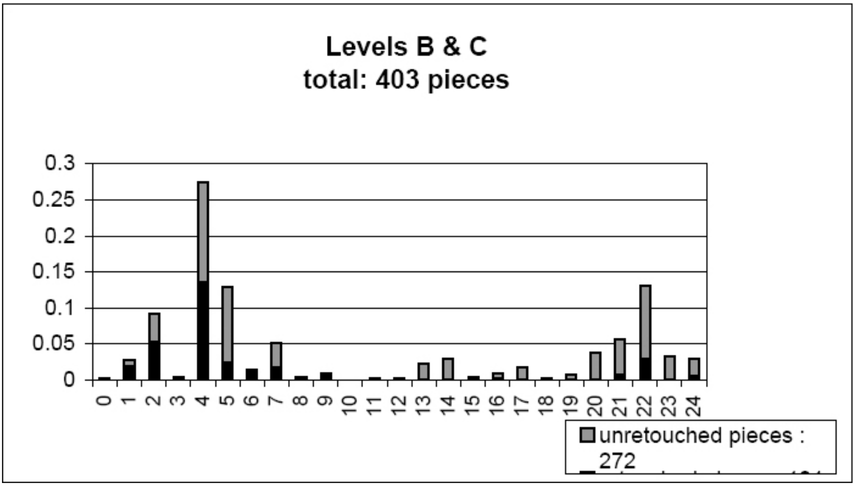
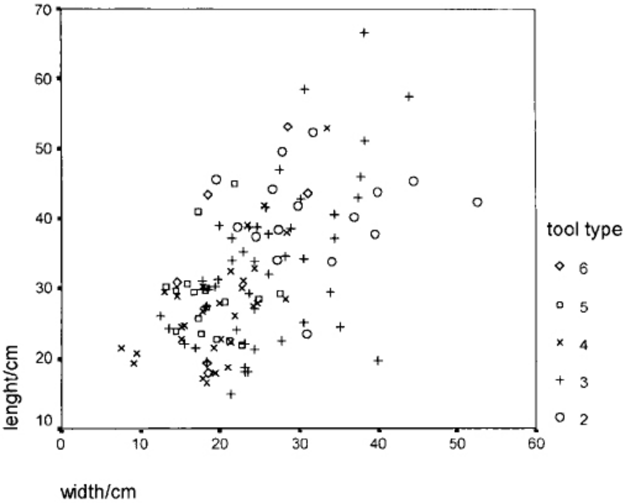


Figure 10.5. Frequency bar charts of Mousterian technological products of lithic assemblages of Mujina Pećina. Category 0 indicates locating and obtaining raw material. For categories 1–8, complete pieces, as well as fragments with and without bulb of percussion, are included. Category 1 indicates initial phase of production. Categories 2–19 represent the next phase of production, which involve the formation of secondary decortication and regular flakes (without cortex), blades and Levallois points. Categories 2–10 represent items knapped from different cores (different flakes and blades). Categories 11–17 represent various types of cores while categories 18 and 19 are specific products of core preparation or rejuvenation. Category 20 represents the final phase of reduction – retouching of tools. Categories 21–24 can be parts of any of the phases in the reduction sequence, and thus cannot be classified like the other categories.


dimensions of tools in levels B and C

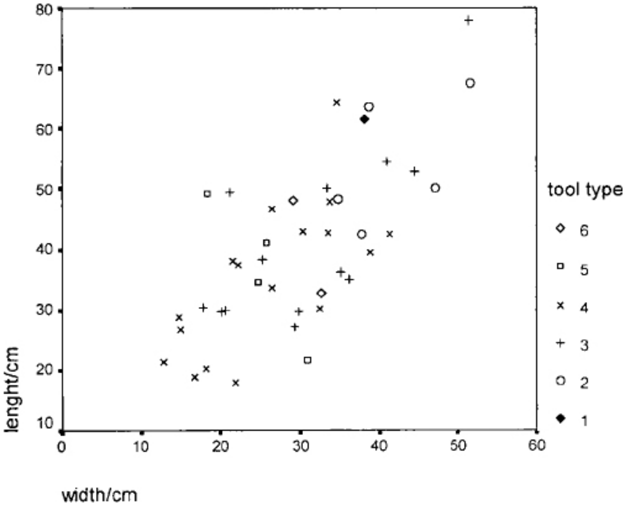

dimensions of tools in levels D1 and D2

Figure 10.6. Graphs of Mujina Pećina tool types and tool length and width: 1. Mousterian points, 2. sidescrapers, 3. denticulates, notched pieces and becs, 4. retouched flakes, 5. Upper Palaeolithic types, 6. various.

A high percentage of flakes, including primary and secondary decortication flakes has been modified into tools. This is especially visible in layers B and C. The high frequency of tool production on decortication flakes suggests an economical use of local raw material.

Small tools (like those of the so-called 'Micromousterian') have been found alongside Mousterian tools of usual size (Figures 10.6 and 10.7). In levels B and C almost all types of tools are small in size, whereas in levels D1 and D2 small size is mostly seen in denticulates and retouched flakes. Small tool size can be explained by the size of local raw material used for the tool production. One reflection of this is that cortex on cores could not be completely removed due to the small dimensions of the chert pebbles and nodules and therefore many decortication flakes were in fact flakes intended for tool production (Figure 10.7). Another limit to tool size is the structure of some local cherts. Specifically, lithic experiments on local raw materials have demonstrated that it is rarely possible to produce large and regular flakes on this raw material even if a large piece is used. Moreover, some of the larger flakes produced experimentally broke during retouching. Along with these small tools, however, as mentioned above, standard size Mousterian tools have been found in Mujina Pećina, especially in levels D1 and D2. In these levels, retouched flakes are the most dominant type, and represent 40.4% of all tools (Table 10.2 and Figure 10.8). Denticulates and notched pieces, the most frequent types in levels B and C, represent 29.7% of the D1–D2 assemblage, which is still quite high. Sidescrapers and Upper Paleolithic types each comprise 10.6%.

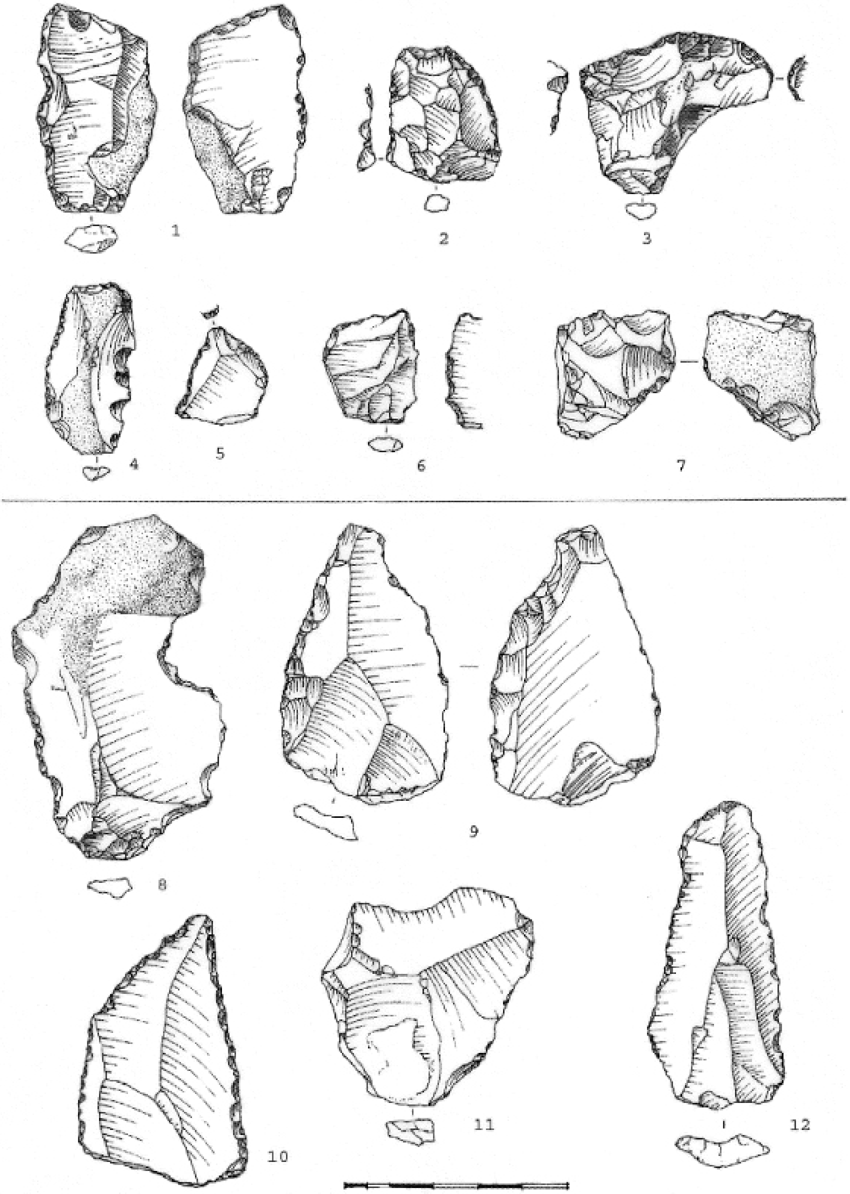


Figure 10.7. Selected artefacts from Mujina Pećina. Level B: 1. denticulated piece, 2. single convex sidescraper, 3. transversal convex sidescraper, 4. notch, 5. alternate retouched bec, 6. drill, 7. flake core with cortex. Level D1: 8. denticulated piece, 9. alternate scraper, 10. Mousterian point, 11. Levallois flake, 12. Levallois blade. Scale is in cm. Drawing by M. Bezić (modified after Rink et al. 2002, Figure 4).

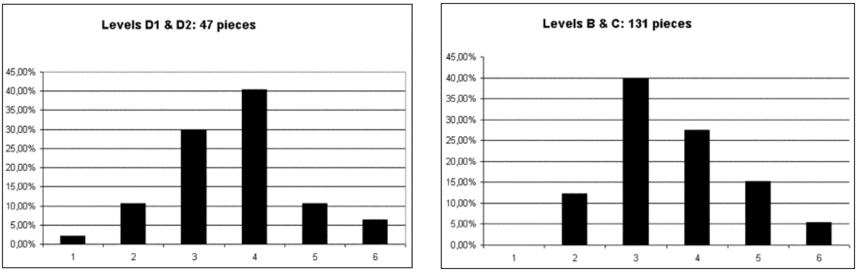
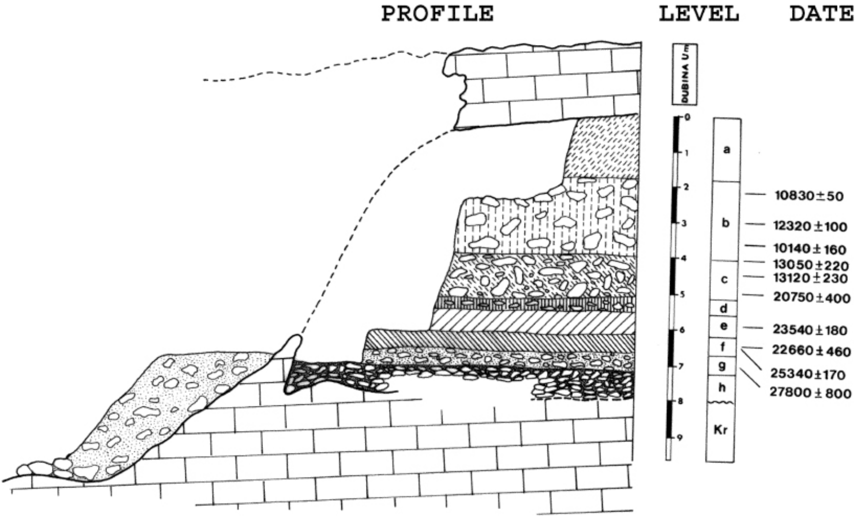


Figure 10.8. Frequency bar charts of main tool types of Mujina Pećina: 1. Mousterian points, 2. sidescrapers, 3. denticulates, notched pieces and becs, 4. retouched flakes, 5. Upper Palaeolithic types, 6. various.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12320±100
10140±160
13050±220
13120±230
20750±400
23540±180
22660±460
25340±170
27800±800

Figure 10.9. Stratigraphic profile of Šandalja II (modified after Malez 1979, Figure 15).

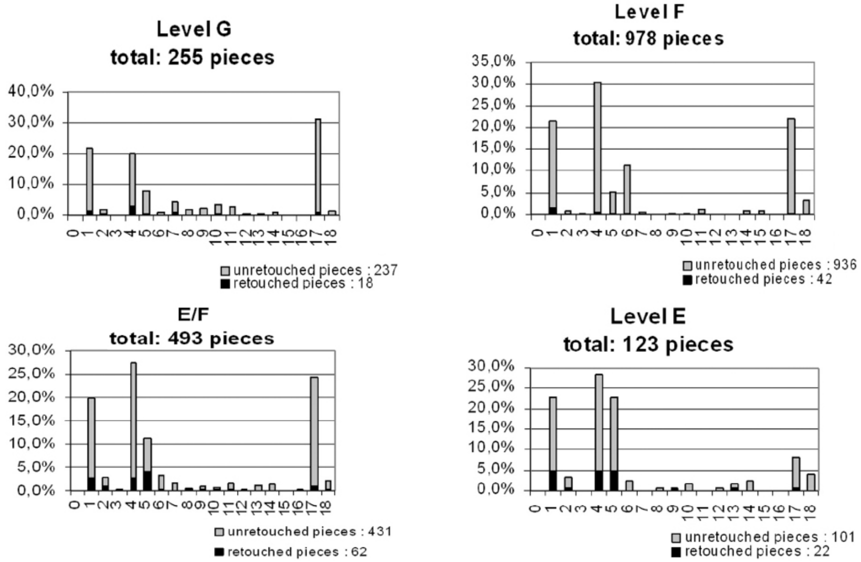

Figure 10.10. Frequency bar charts of technological products of Aurignacian lithic assemblage of Šandalja II. Category 0 indicates locating and obtaining raw material. For categories 1–6, complete pieces, as well as fragments with and without bulb of percussion, are included. Categories 1–3 indicate testing of material and the first phase of production – decortication. Categories 4–14 represent the middle phase of production, which involve the knapping of flakes, blades and bladelets without cortex (whereas categories 4–6 represent the characteristic products knapped from different cores and categories 7–12 represent various types of cores). Categories 13 and 14 are specific products of core preparation or rejuvenation, while categories 15 and 16 represent the final phase of tool production – retouching of the tools. Categories 17–18 can be parts of any of the phases in the reduction sequence and thus cannot be classified, unlike the other categories.

Table 10.3. The quantity and the percentage of the technological categories of Šandalja II.

		level G				*level F*				*level E/F*				*level E*			
	Technological category	retouched pieces		unretouched pieces		retouched pieces		unretouched pieces		retouched pieces		unretouched pieces		retouched pieces		unretouched pieces	
		quantity	%	quantity	%	quantity	%	quantity	%	quantity	%	quantity	%	quantity	%	quantity	%
0	nodule or pebble	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0	0	0.00%
1	corticated flake	3	1.20%	52	20.40%	15	1.50%	196	20.00%	13	2.60%	85	17.20%	6	4.90%	22	17.90%
2	corticated blade	1	0.40%	3	1.20%	0	0.00%	10	1.00%	5	1.00%	9	1.80%	1	0.80%	3	2.40%
3	corticated bladelet	0	0.00%	0	0.00%	0	0.00%	4	0.40%	0	0.00%	1	0.20%	0	0.00%	0	0.00%
4	flake	8	3.10%	43	16.90%	7	0.70%	291	29.80%	13	2.60%	122	24.70%	6	4.90%	29	23.60%
5	blade	1	0.40%	19	7.50%	4	0.40%	48	4.90%	20	4.10%	35	7.10%	6	4.90%	22	17.90%
6	bladelet (3 cm or less in size)	0	0.00%	2	0.80%	2	0.20%	109	11.10%	1	0.20%	16	3.20%	0	0.00%	3	2.40%
7	flake core	2	0.80%	9	3.50%	1	0.10%	4	0.40%	0	0.00%	8	1.60%	0	0.00%	0	0.00%
8	blade core	0	0.00%	4	1.60%	0	0.00%	0	0.00%	1	0.20%	1	0.20%	0	0.00%	1	0.80%
9	bladelet core	0	0.00%	5	2.00%	2	0.20%	0	0.00%	1	0.20%	4	0.80%	1	0.80%	0	0.00%
10	mixed core	1	0.40%	8	3.10%	3	0.30%	1	0.10%	1	0.20%	3	0.60%	0	0.00%	2	1.60%
11	core fragment	0	0.00%	7	2.70%	2	0.20%	9	0.90%	1	0.20%	7	1.40%	0	0.00%	0	0.00%
12	splintered piece	0	0.00%	1	0.40%	0	0.00%	0	0.00%	0	0.00%	1	0.20%	0	0.00%	1	0.80%
13	crested piece	0	0.00%	1	0.40%	0	0.00%	1	0.10%	0	0.00%	6	1.20%	1	0.80%	1	0.80%
14	core renewal flake	0	0.00%	2	0.80%	1	0.10%	8	0.80%	0	0.00%	7	1.40%	0	0.00%	3	2.40%
15	retouch flake	0	0.00%	0	0.00%	0	0.00%	10	1.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
16	burin spall	0	0.00%	0	0.00%	1	0.10%	0	0.00%	0	0.00%	1	0.20%	0	0.00%	0	0.00%
17	chunk	2	0.80%	78	30.60%	4	0.40%	213	21.80%	5	1.00%	115	23.30%	1	0.80%	9	7.30%
18	unidentifiable fragment	0	0.00%	3	1.20%	0	0.00%	32	3.30%	1	0.20%	10	2.00%	0	0.00%	5	4.10%
	Total	**18**	**7.10%**	**237**	**92.90%**	**42**	**4.30%**	**936**	**95.70%**	**62**	**12.60%**	**431**	**87.40%**	**22**	**17.90%**	**101**	**82.10%**

Šandalja II

The Šandalja II site is located near the city of Pula, and was excavated by Mirko Malez on 22 occasions, between 1962 and 1989 (Miracle 1995). All the sediment has been removed, except for the part of the preserved profile.

Basic stratigraphy of the site is over 8 m thick (Figure 10.9) and has been divided into 8 layers (A–H) (Malez 1979, 1987). They are composed of compact or sandy clay with large or small rock fragments, containing Upper Paleolithic (Aurignacian and Epigravettian) lithics, fauna and human (Epigravettian) remains (Malez 1979; Brajković 2000). Layers G, F, and E provided radiocarbon dates between 28 and 23 ka BP (Malez and Vogel 1969; Srdoč *et al.* 1979). Material in layers H and G/H is scarce and attributable to the early Upper Paleolithic. Much more lithic finds come from the stratigraphic units G, F, E/F, and E, and this material has been divided into 19 separate categories (Table 10.3).

Category 0 indicates locating and obtaining raw material. For categories 1–6, complete pieces, as well as fragments with and without bulb of percussion, are included. Categories 1–3 indicate testing of material and the first phase of production – decortication. Categories 4–14 represent the middle phase of production, which involves the knapping of flakes, blades and bladelets without cortex (whereas categories 4–6 represent the characteristic products knapped from different cores and categories 7–12 represent various types of cores). Categories 13 and 14 are specific products of core preparation or rejuvenation, while categories 15 and 16 represent the final phase of tool production – retouching of the tools. Categories 17–18 can be parts of any of the phases in the reduction sequence and thus cannot be classified, unlike the other categories.

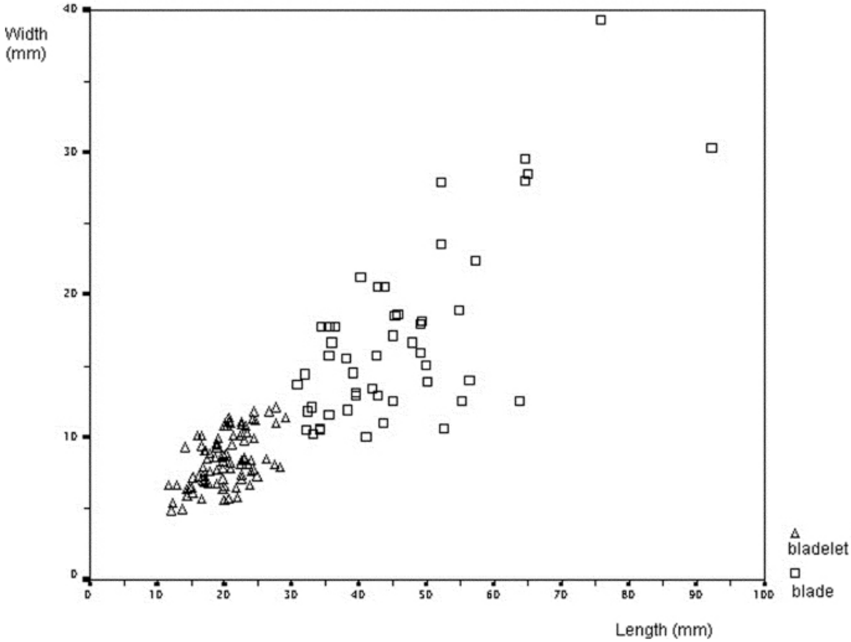

Figure 10.11. Graph of length and width of unretouched blades and bladelets (with and without cortex) from stratigraphic units F, E/F and E of Šandalja II.

Table 10.4. The quantity and the percentage of tool types of Šandalja II.

	tool types according to de Sonneville-Bordes and Perrot (1953)	*level G*		*level F*		*level E/F*		*level E*	
		quantity	%	quantity	%	quantity	%	quantity	%
1	simple endscraper	1	5.60%	3	7.10%	4	6.50%	1	4.50%
2	atypical endscraper	0	0.00%	4	9.50%	1	1.60%	0	0.00%
5	endscraper on retouched blade or flake	2	11.10%	0	0.00%	2	3.20%	0	0.00%
8	endscraper on flake	0	0.00%	1	2.40%	0	0.00%	0	0.00%
11	carinated endscraper	0	0.00%	2	4.80%	1	1.60%	4	18.20%
12	atypical carinated endscraper	3	16.70%	3	7.10%	2	3.20%	0	0.00%
13	nosed endscraper	0	0.00%	7	16.70%	0	0.00%	0	0.00%
15	nuceliform endscraper	0	0.00%	2	4.80%	4	6.50%	0	0.00%
16	rabot	1	5.60%	0	0.00%	1	1.60%	1	4.50%
23	perforator	0	0.00%	0	0.00%	1	1.60%	0	0.00%
24	atypical perforator	0	0.00%	0	0.00%	0	0.00%	1	4.50%
29	angle dihedral burin	0	0.00%	0	0.00%	1	1.60%	0	0.00%
30	angle burin on break	0	0.00%	0	0.00%	1	1.60%	0	0.00%
31	mulitple dihedral burin	1	5.60%	0	0.00%	0	0.00%	0	0.00%
34	burin on a straight retouched truncation	0	0.00%	0	0.00%	1	1.60%	1	4.50%
35	burin on an oblique truncation	0	0.00%	0	0.00%	1	1.60%	1	4.50%
36	burin on a concave truncation	0	0.00%	1	2.40%	0	0.00%	1	4.50%
37	burin on a convex truncation	0	0.00%	0	0.00%	1	1.60%	0	0.00%
38	burin on a lateral truncation	0	0.00%	1	2.40%	0	0.00%	0	0.00%
39	transverse burin on notch	0	0.00%	0	0.00%	1	1.60%	0	0.00%
44	flat burin	0	0.00%	0	0.00%	1	1.60%	0	0.00%
58	fully backed blade	0	0.00%	0	0.00%	1	1.60%	0	0.00%
60	piece with a straight truncation	0	0.00%	0	0.00%	1	1.60%	0	0.00%
65	piece with continuous retouched - one edge	0	0.00%	1	2.40%	13	21.00%	2	9.10%
66	piece with continuous retouched - two edges	0	0.00%	0	0.00%	2	3.20%	2	9.10%
74	notched piece	1	5.60%	5	11.90%	5	8.10%	3	13.60%
75	splintered piece	1	5.60%	4	9.50%	2	3.20%	0	0.00%
77	sidescraper	5	27.80%	3	7.10%	6	9.70%	1	4.50%
78	raclette	0	0.00%	0	0.00%	0	0.00%	2	9.10%
92	various	3	16.70%	5	11.90%	9	14.50%	2	9.10%
	Total	**18**	**100.00%**	**42**	**100.00%**	**62**	**100.00%**	**22**	**100.00%**

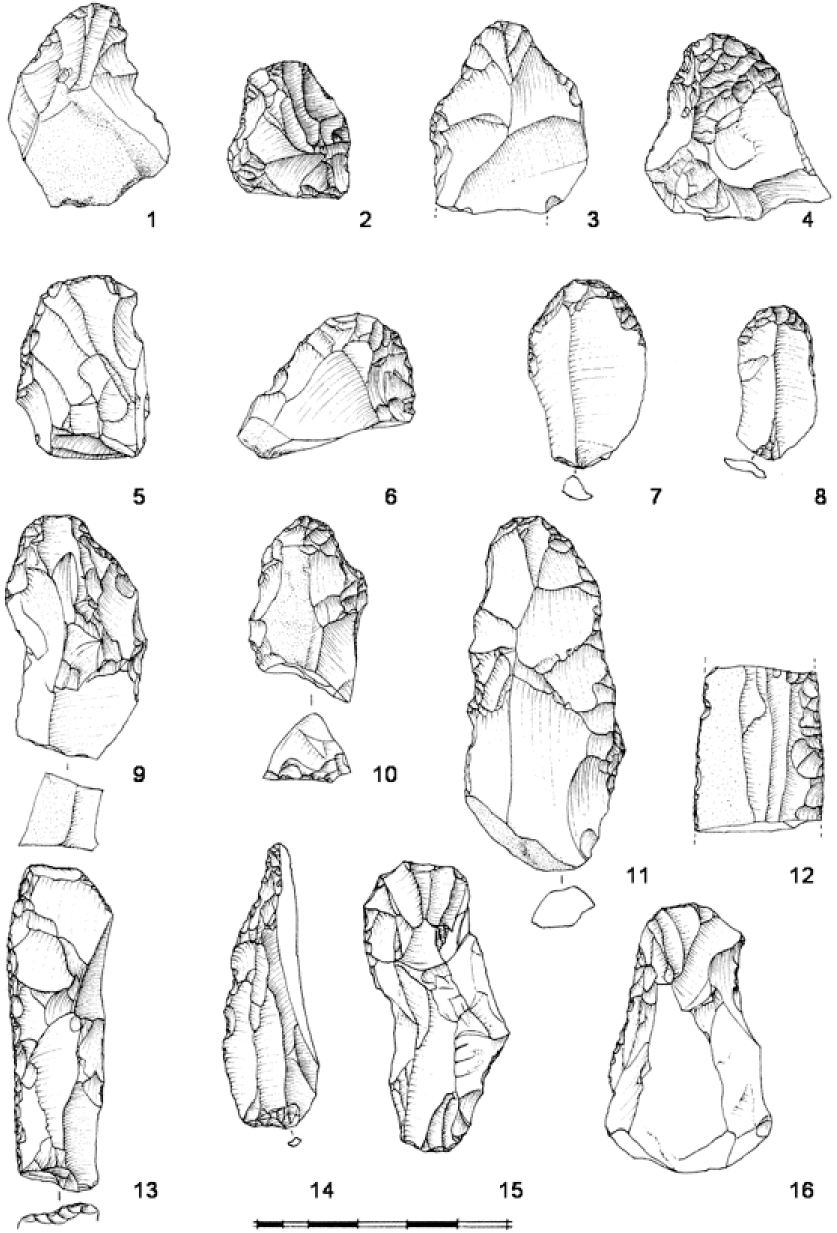

Figure 10.12. Selected artefacts from Šandalja II. Level F: 1-4, 9, 10. nosed endscrapers, 5. atypical carinated endscraper, 6. endscraper on flake, 7-8. simple endscrapers. Level E: 11, 15, 16. carinated endscrapers, 12. blade with two continuously retouched edges, 13. blade with one continuously retouched edge and truncation, 14. atypical perforator. Scale is in cm. Drawing by M. Perkić.

Debitage items in Aurignacian levels, mainly produced on local grey chert, are often patinated. Out of 255 stone artifacts found in level G, 18 (7.1%) belong to definable tool types. Level F contains a total of 978 stone artifacts of which 42 pieces (4.3%) represent tools, while the E/F interface contains a stone assemblage of 493 pieces, of which 62 (12.6%) pieces are tools. Only 123 stone artifacts, of which 22 (17.9%) are tools, are found in level E.

Flakes are most common, while bladelets are more numerous than blades only in level F (Table 10.3 and Figure 10.10). Bladelets include pieces that are up to 3 cm long, while blades are more than 3 cm long (Figure 10.11). Both blades and bladelets were produced by direct percussion using a soft hammer. Flakes from retouching are very rare. This could be the result of the excavation method given that sieving was not practised. Thus, this may not reflect a true lack of retouching at the site itself. The large number of chunks is easily explained by the use of the local grey chert, which breaks irregularly. The very small percentage of tools could be explained either by their production elsewhere or, alternatively, by hominins having taken them from the site.

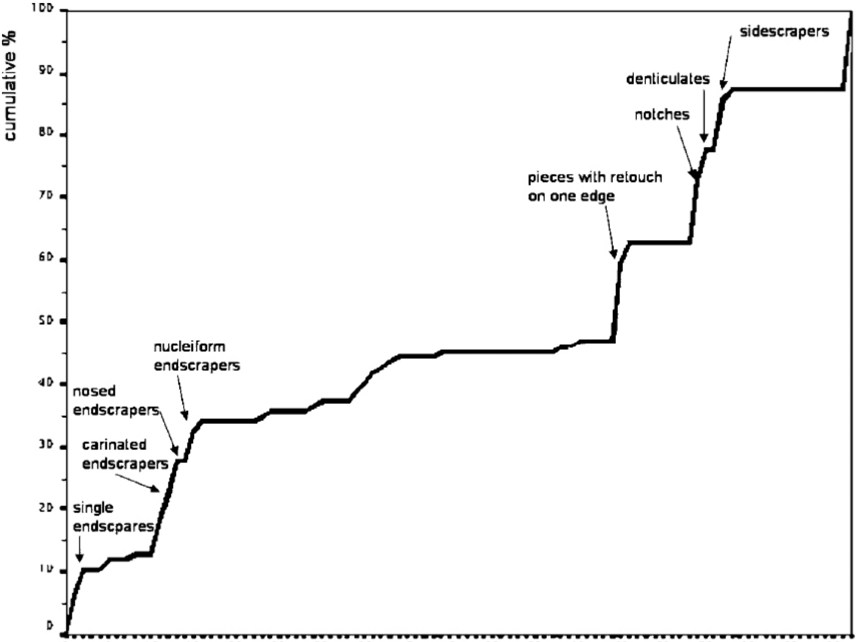

Figure 10.13. Cumulative percentage graph of stone tool types in stratigraphic units F, E/F, E. Horizontal axis lists tool type numbers according to de Sonneville-Bordes and Perrot (1953).

Nosed and carinated endscrapers are quite common, while Aurignacian blades are missing (Table 10.4, Figures 10.12 and 10.13). Side-scrapers and notches are present in significant quantities. Dufour bladelets are missing from the sample but it is not clear whether this reflects a real situation at the site or the fact that the sediment was not sieved. On the other hand, Epigravettian layers that were excavated using the same archaeological methods have yielded numerous smaller finds (for example, the backed bladelets), therefore making it likely that the Dufour bladelets would have been collected, if present, in the layers. Although Dufour bladelets are missing, the lithic industry of the stratigraphic units F, E/F and F represents the Aurignacian.

The most common bone tools in these units are awls, while four pierced animal teeth from the Aurignacian layers represent decorative items and suggest symbolic behavior (Karavanić 2003, Figure 9). On two of them the root was thinned by scraping before the actual piercing was done. The root of the third tooth was damaged, while the fourth tooth (although damaged), also shows deliberate thinning of the root. A small split-base bone point, of circular cross-section (see Karavanić 2003, Figure 9) found at Šandalja II (layer G) is more similar to some examples from the Franco-Cantabrian Magdalenian (L. G. Straus, personal communication) than to the Aurignacian.

Discussion

The Dalmatian area has several known Mousterian sites. Many Mousterian lithic finds from this region were collected on the surface of open-air sites and were often found in mixed cultural contexts (Batović 1988), while the only systematically excavated and chronometrically dated Mousterian site in Dalmatia is Mujina Pećina (Rink *et al.* 2002). In contrast to the situation in Dalmatia, the Istrian peninsula has no known Mousterian sites while Šandalja II contained sediments with an Aurignacian industry. Although in the Mousterian sequence of Mujina Pećina some Upper Paleolithic tool types are present, and in the Aurignacian layers of Šandalja II Middle Paleolithic tool types are numerous, neither industry shows a progressive transitional nature (Karavanić 2007). The technological difference between these sites is quite distinctive. Blades are rare in the Mousterian of Mujina Pećina, and, when present, produced by hard hammer with Levallois method, while in the Aurignacian of Šandalja II these are very common and produced using a soft hammer. Furthermore, worked bone tools and perforated teeth have been found in the Aurignacian of Šandalja II while there are no such items present in the Late Mousterian of Mujina Pećina.

Aside from Šandalja II, other early Upper Paleolithic sites in the Eastern Adriatic region and its hinterland are very rare. For example, the bone point discovered in Bukovac Pećina near Lokve in the Gorski Kotar area was attributed to the Aurignacian (Malez 1979). Although its base is missing, it is quite possible that it was split, and the find might be related to the Olschewian (Horusitzky 2004). Upper Paleolithic tools attributed to the Aurignacian mixed with the Middle Paleolithic (Mousterian) material were discovered on the surface of some open air sites in Dalmatia (Malez 1979; Batović 1988). The fact that the archaeological material was mixed and that there were a very limited number of Aurignacian tool types, makes the attribution of these sites to the Aurignacian industry unreliable. One exception might be an open air site near St. Peter church, north-east of Zadar, where a few nosed endscrapers were collected on the surface (D. Mustać personal communication).

Although Z. Kujundžić (1989, 12) attributed the tools discovered with a few flakes in the upper part of layer IV at Gigića Pećina near Bosansko Grahovo (Bosnia and Herzegovina) to the Upper Aurignacian (Aurignacian II), it seems that there were no typical Aurignacian tools like keeled and nosed endscrapers and thus it is possible that the Upper Paleolithic tools of Gigića Pećina are attributable to the Epigravettian instead of the Aurignacian. A similar problem is also present at the site of Crvena Stijena near Nikšić, in Montenegro (Basler 1979). The finds from layer X, which were attributed by Đ. Basler (1979, 397) to the "locally nuanced *Aurignacian*", very probably represent the Epigravettian (Montet-White 1996, personal communication). Although Crvena Stijena in Montenegro (Basler 1979) contains both Middle and Upper Paleolithic layers, there is no evidence of *in situ* transition at this site, nor at any other site in the Eastern Adriatic region. It is not clear why no site in the Eastern Adriatic region thus far documents the Middle/Upper Paleolithic transition, nor why early Upper Paleolithic sites are very rare. Possible reasons for this include: not many sites having been explored, flooding or abrasion as a result of the rising of the sea level, low population density in the area during the Middle/Upper Paleolithic transition and in the early Upper Paleolithic. Although research has intensified these last few years compared to before, in the Istria region only one site has been found that probably dates to the early Upper Paleolithic (D. Komšo personal communication). It is therefore to be expected that this lack of more sites is a result of all three suggested causes.

Along with the re-assessment of old collections, current fieldwork should provide new evidence of importance to the interpretation of the late Middle Paleolithic and early Upper Paleolithic of the eastern Adriatic.

Acknowledgments

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11. Dating and Paleoenvironmental Interpretation of the Late Pleistocene Archaeological Deposits at Divje Babe I, Slovenia

Bonnie A. B. Blackwell, Edwin S. K. Yu, Anne R. Skinner, Ivan Turk, Joel I. B. Blickstein, Dragomir Skaberne, Janez Turk and Beverly Lau

Abstract

New chronological, sedimentary morphometric and diagenetic analyses were combined to determine sedimentation rates, relative humidity, and paleotemperatures for the Middle to Early Upper Paleolithic deposits at Divje Babe I, Slovenia's oldest archaeological site. Its thick archaeological sequence housed Mousterian artefacts, including hearths, a perforated ursid femur interpreted as a flute, bone tools, and ~ 200,000 cave bear (Ursus spelaeus) skeletal remains (NISP).

Eleven archaeologically significant layers were dated by 42 independent standard ESR (electron spin resonance) analyses from 26 teeth. To calculate volumetrically averaged external dose rates, > 190 sedimentary component samples were analyzed by NAA. Sediment was also analyzed for grain size, geochemistry, cryoturbation, cataclasis, pre- and post-depositional corrosion, secondary cementation, and aggregate formation. Local paleotemperature estimates were verified by comparing with palynological determinations and then compared to global $\delta^{18}O$ *and palynological records.*

Numerous sedimentary characteristics indicate that Divje Babe experienced strong climatic fluctuations during the Late Pleistocene. During the colder phases, pre- and post-depositional corrosion, post-depositional frost wedging, and cryoclasis dominated the sedimentary processes, but these are intercalated with layers in which geochemical data, secondary cementation and aggregate formation suggest slightly warmer and wetter conditions, indicating four distinct interstadials and five stadials in OIS 3–4 and prolonged warm interglacial conditions in OIS 5, during which hominids visited the cave intermittently, discarding Mousterian artefacts. From Layers 2 to 23, the ESR dates suggest that at least three, and probably four, periods of rapid sedimentation alternated with depositional hiati. Continuous sedimentation at 0.02 cm/y from approximately 116 ka to 102 ka during Oxygen Isotope Stage (OIS) 5d deposited Layer 23 through the lower Layer 17a2 under warm, dry to moderately humid conditions. During OIS 5b–5c, sedimentation slowed dramatically or ceased until about 85 ka. In early OIS 5a, Dansgaard-Oeschger (DO) Event 21, from approximately 85 ka until 80 ka, sedimentation averages 0.036 cm/y, depositing upper Layer 17a2 through Layer 13 *under warm, but dry to moderately dry conditions. The next hiatus spanned the first cold phase in OIS 4 until about 70 ka. Rapid deposition at approximately 0.012 cm/y resumed with Layers 10–12 through 8a, from about 70 to 55 ka, during the latter part of OIS 4, under cool to cold, humid conditions. The flute was produced and abandoned at about 60 ka. Sedimentation slowed again from about 55 until 50 ka, during early OIS 3. From about 50 to 38–40 ka during Moershoofd-Glinde and Hengelo Interstadials, DO 14–10 in OIS 3, sedimentation resumed at about 0.04 cm/y, depositing Layers 7 to 2 under conditions that varied widely from very cold to moderately warm, but from dry to moderately humid. The Pleistocene stratigraphic sequence ends with Layer 2, which contains Early Aurignacian tools, including a split-based antler point, in sediment hinting at interstadial conditions. During OIS 2, deep cryoturbation disturbs Layers 2–5a. In the Early Holocene, after a 28–30 ky hiatus, modest sedimentation resumed.*

Introduction

Divje Babe I remains Slovenia's oldest Paleolithic archaeological site, as well as the site with the longest nearly continuous sedimentological record during the Late Pleistocene. It is most famous for its flute made from cave bear (*Ursus spelaeus*) femur, which was found associated with Mousterian artefacts. Initially, Lau *et al.* (1997) showed the flute to be $>$ 43 ka. Subsequent research concentrated on producing a more detailed chronology and reliable paleoclimatic determinations for Layer 8, in particular, and for the stratigraphic sequence, as a whole, as well as checking to ensure reworking had not affected the dated teeth (*cf.* Blackwell 1994). For the layers beyond the maximum AMS ^{14}C dating limit (i.e., approximately 40–45 ka; Nelson 1997), ESR (electron spin resonance) in tooth enamel was used to determine 42 independent dates for 26 *Ursus spelaeus* teeth for Layers 7 through 20 to enable it to be correlated with other sites in the region, and to establish the chronology for paleoenvironmental changes in the Slovenian Alps during the Late Pleistocene.

The Divje Babe I Site

Divje Babe I is a cave containing a Late Pleistocene Paleolithic site, situated at about 450 m elevation overlooking the Idrijca River valley, near Idrija, about 50 km east of Ljubljana (Figure 11.1). The cave developed along faults associated with the Kneža Fault in massive Triassic Cordevolian dolomite. Excavations by Mitja Brodar (1999) ran from 1980 to 1986. Ivan Turk (2003a, 2003b) and Janez Dirjec began new excavations in 1989, which continued until 1999 (Turk *et al.* 1995a; Turk and Dirjec 1997; Bastiani *et al.* 2000; Turk and Bastiani 2000).

Within Divje Babe, several sedimentation processes, including roof collapse, mass wasting, cryoturbation, carbonate and phosphate corrosion, strong post-depositional weathering, including dissolution and reprecipitation, and faunal and hominid occupation, have all acted to produce a complex sequence of largely inhomogeneous sedimentary layers (Figure 11.2). Initially, Turk *et al.* (1989) identified six sedimentation cycles, thought to represent one Holocene and five Late Pleistocene sequences. Further analyses using a closer sampling interval showed that only three to four major sedimentary units (facies) actually existed (Turk 2003a). At the cave mouth, a typical talus deposit (*cf.* Bordes 1984) occurs, which had been partially eroded by solifluction during the Latest Pleistocene. Although the excavations did not reach bedrock in the cave, 26 stratigraphic layers have been identified in the cave, all of which contain significant quantities of dolomitic *éboulis*, ranging from sand to boulder size, in dolomitic silt and sand grains. While Layers 17a2, 17a3, and 20 contain sporadic flowstone, and Layer 8 has some stalactites, Layer 2 has experienced massive secondary carbonate deposition and Layer 17/18, secondary calcite precipitation to form small aggregates. Several others, however, have secondary phosphatic cements, encrustations, and crusts. The abundant fossil remains coupled with periodically abundant water caused phosphatic dissolution throughout the sequence resulting in secondary reprecipitation, which post-depositionally cemented all Layer 8a and parts of Layers 7–8, 10–11, 16, 18a, 19, 20, 22, and 23. Layers 2–5a show significant cryoturbation and dry *éboulis* deposition in pockets, suggesting very cold climates with periglacial conditions in the cave, probably correlated with Oxygen Isotope Stage (OIS) 2. Layers 16–17 show significant cryoturbation and locally massive *éboulis* deposition, prior to the phosphatic deposition there. The phosphate mobilization in Layers 8, 10–14, and 16 suggests that these layers were waterlogged for some significant time (Turk *et al*. 1988, 1989).

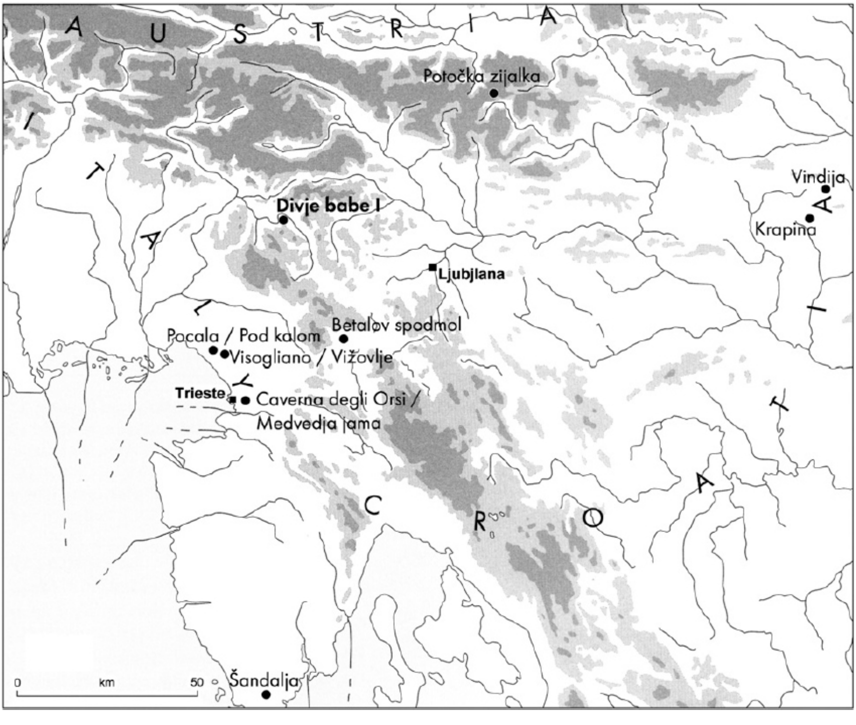

AUSTRIA
Potočka zijalka
ITALY
Vindija
Krapina
Divje babe I
Ljubljana
Betalov spodmol
Pocala / Pod kalom
Visogliano / Vižovlje
Trieste
Caverna degli Orsi / Medvedja jama
CROATIA
0 km 50
Šandalja

Figure 11.1. Divje Babe I Cave, Slovenia. The cave is located at 450 m elevation, approximately 230 m above the Idrijca River valley, in northwestern Slovenia.

The cave was primarily a cave bear den during the late Pleistocene. Among the fossil remains, > 99% (>100,000 teeth) derive from the late Pleistocene cave bear, *Ursus spelaeus* (Turk 2003b; Turk *et al.* 1992). Although highly concentrated in Layers 7 to 13 (Figure 11.3), bear bones occur in all layers (Table 11.1). Roughly 80% of the teeth are deciduous, and 20%, permanent. Most teeth are recently erupted showing little wear, suggesting that the cave was a nursery where some cubs and their mothers died during hibernation (Debeljak 2002). Divje Babe also yielded cave bear hair imprints and fossilized hair (Turk *et al.* 1995b), while carbon and nitrogen isotopic analysis confirmed for the first time that cave bears did indeed hibernate (Nelson *et al.* 1998). Given the ubiquity of the bear remains and their complete interstratification with the Mousterian artefacts, undoubtedly humans utilized the site, probably during the warmer months when the bears were not defending their dens.

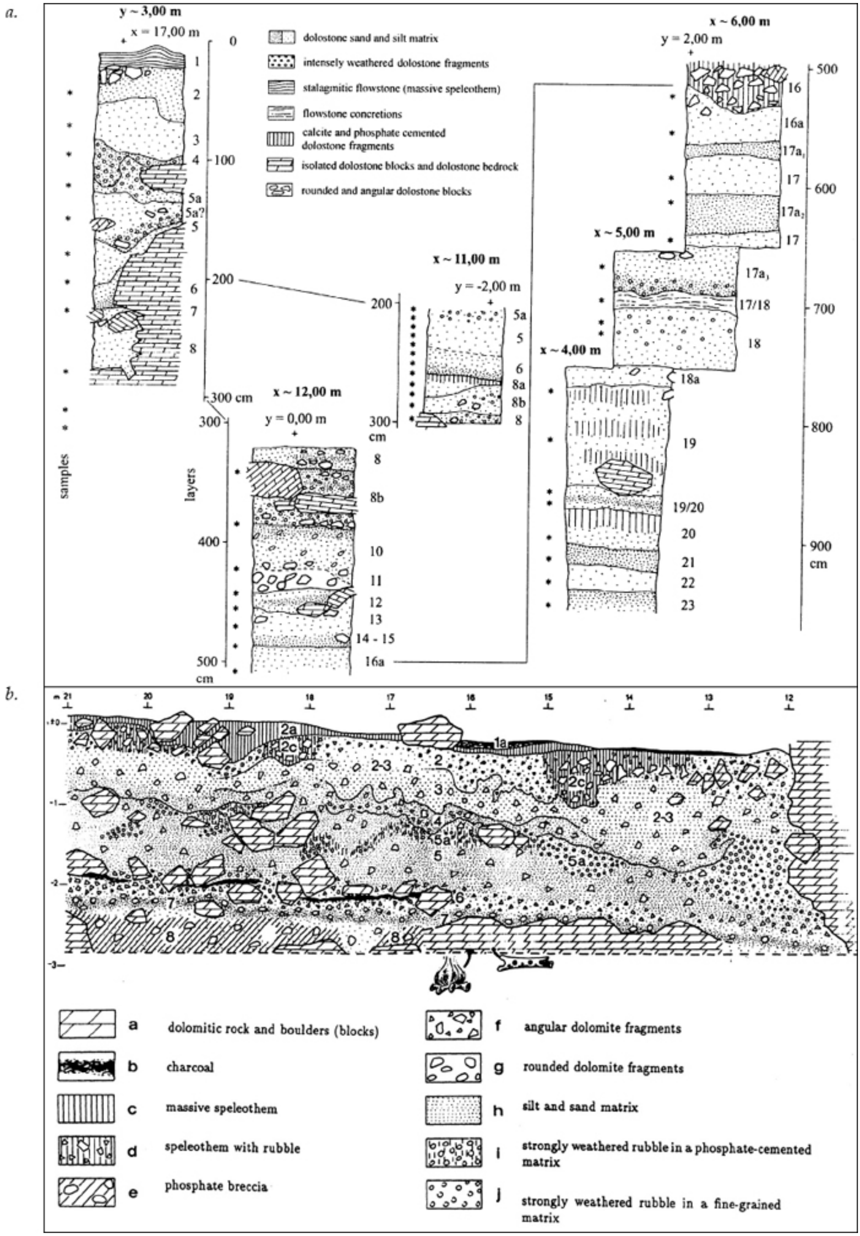

a.
y ~ 3,00 m
x = 17,00 m
0
100
200
300 cm
samples
layers
1
2
3
4
5a
5a?
5
6
7
8
dolostone sand and silt matrix
intensely weathered dolostone fragments
stalagmitic flowstone (massive speleothem)
flowstone concretions
calcite and phosphate cemented dolostone fragments
isolated dolostone blocks and dolostone bedrock
rounded and angular dolostone blocks
x ~ 12,00 m
y = 0,00 m
300
400
500 cm
8
8b
10
11
12
13
14 - 15
16a
x ~ 11,00 m
y = -2,00 m
200
300 cm
5a
5
6
8a
8b
8
x ~ 6,00 m
y = 2,00 m
500
600
700
800
900 cm
16
16a
17a1
17
17a2
17
x ~ 5,00 m
17a1
17/18
18
x ~ 4,00 m
18a
19
19/20
20
21
22
23
b.
21
20
19
18
17
16
15
14
13
12
±0
-1
-2
-3
1a
2a
2c
2
2-3
3
4
5a
5
6
7
8
a
dolomitic rock and boulders (blocks)
b
charcoal
c
massive speleothem
d
speleothem with rubble
e
phosphate breccia
f
angular dolomite fragments
g
rounded dolomite fragments
h
silt and sand matrix
i
strongly weathered rubble in a phosphate-cemented matrix
j
strongly weathered rubble in a fine-grained matrix

Figure 11.2. The stratigraphy at Divje Babe I, Slovenia. At least 26 stratigraphic layers have been identified in the cave: a. A composite section containing several cuts in the 1998–2000 excavation used to recover sediment for ESR and paleoclimatic analyses from various locations in the cave. b. Cut y = – 2.00 m at the rear of the cave. Many layers contain significant amounts of large dolomitic éboulis, which make all the layers inhomogeneous, especially near the cave mouth. Aurignacian tools occur in Layer 2, while Layers 4 through 20 host Mousterian artefact

assemblages, along with hearths. The bone flute was found at 2.8 cm depth ~ 30 cm from a hearth in Layer 8 (adapted from Lau et al. 1997; Turk et al. 2005).

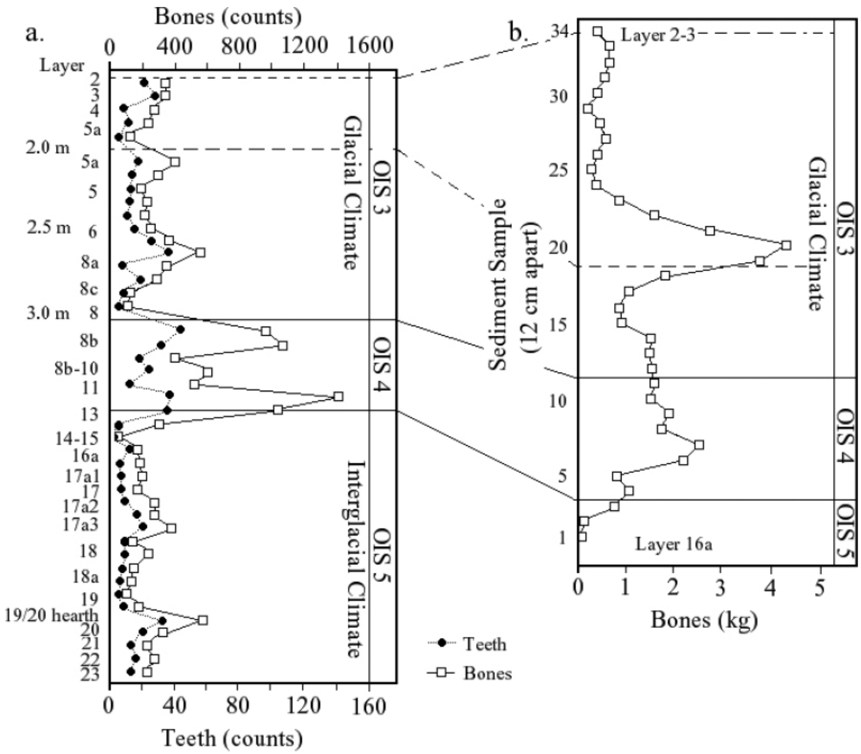


Figure 11.3. Fossil remains at Divje Babe I, Slovenia. Approximately 100,000 cave bear teeth and many bones have recovered from Divje Babe I: a. The total number of all fossil remains has been normalized to the sediment volume in the composite sedimentary profile (see Figure 11.2b). The largest numbers of cave bear bones and teeth occur in Layers 8b and 10–12, with minor peaks in Layers 2, 8a, and 19/20. b. The total mass of bones normalized to the sediment volume for Layers 2 to 15. Nonetheless, all layers contain large masses of fossils, with the highest bone density in Layer 7. Ages were derived from ^{14}C, $^{230}Th/^{234}U$, and ESR analyses. This suggests that occupation by the bears, or the bear mortality rate, was most intense at about 40 ka, and from 50 to 67 ka, during OIS 3 and 4 (adapted from Turk et al. 2002).

Divje Babe is also the richest Late Pleistocene site in Slovenia for fauna, charcoal, and pollen (Šercelj and Culiberg 1991; Toškan 2003) with more than 60 reported faunal species, including some rare large animals like *Alopex lagopus* (Arctic fox), *Panthera pardus* (leopard), *Lynx lynx*, *Capreolus capreolus* (roe deer), *Rupicapra rupicapra* (chamois), and small mammals like *Clethrionomys glarelous* (bank vole), *Chionomys nivalis* (snow vole), *Glis glis* (dormouse), arvicolids, and bats (Toškan 2003). The fauna, pollen, and charcoal all indicate an alpine and predominantly temperate forest near the cave, similar to today's environment with occasionally boreal elements (Culiberg and Šercelj 1998; Šercelj and Culiberg 1991). *Pinus* (pine) dominates the pollen, but *Fagus* (beech) and other deciduous forms do occur. In the charcoal found associated with hearths, *Fagus*, *Carpinus* (ironwood), *Fraxinus* (ash), *Acer* (maple), *Taxus* (yew), *Picea* (spruce), and *Pinus cembra* all occur. Except in Layer 1 (Holocene), all the fauna and flora show stronger affinities with the southern Alps than central Europe, suggesting temperate climates that slowly degraded near the top to colder conditions (Šercelj and Culiberg 1991). The glacial conditions in Slovenia were humid rather than dry, as shown by the sediment diagenesis, floral and faunal records at Divje Babe I. This provided abundant precipitation, particularly during the summer, and thus, sufficient moisture for mesophiles to survive during the glacial advances (Culiberg and Šercelj 1998; Toškan 2003).

Table 11.1. Selected Sedimentological Data with Climatic Interpretations

		Occurrence		Mass[3]		Abundance	Mass[3]		Average Volume[4]			Climatic Interpretation		
Layer[1]	Cut	Cementation ("breccia")	*Ursus spelaeus* remains[2]	Bone fragments 0.5 mm < x < 3 mm (g)	Bone fragments 3 mm < x (g)	Congelifracts 10 mm < x < 40 mm (%)	Blocks 65 mm < x (kg)	Silt x < 0.5 mm (kg)	Blocks 65 mm < x (cm^3)	Gravel $x < 10^3$ mm (cm^3)	Silt x < 0.5 mm (cm^3)	based on Congelifracts	based on Aggregates	OIS (MIS)
2	**A**	**yes**	**spor.**	**36.0**	**66**	**16.6**	**3.8**	**11.6**	**90**	**0.10**	**1.08**	**temperate**	**arid**	**3**
3	A	no	spor.	29.1	65	13.5	3.7	11.4	74	0.11	1.12	temperate	arid	3
4	A	no	spor.	17.6	49	24.5	4.2	10.5	85	0.08	1.15	cold	arid	3
5a up	A	no	spor.	9.8	90	37.2	4.0	11.8	78	0.08	1.08	cold	humid	3
5a low	A	no	spor.	11.3	20	17.2	4.0	9.5	53	0.08	1.06	temperate	humid	3
5	A	no	spor.	19.7	110	14.4	2.2	10.1	50	0.11	1.11	temperate	arid	3
6	A	no	spor.	11.5	127	27.1	8.3	4.6	97	0.10	1.19	cold	arid	3
7	B	no	abund.	46.3	536	6.6	2.8	6.1	82	0.10	1.08	temperate	humid	3
8c	B	no	abund.	24.9	269	26.8	**18.7**	3.0	**244**	0.09	1.04	cold	humid	3
8b up	B	no	abund.	24.4	308	18.5	5.0	8.8	67	0.09	0.95	temperate	humid	3
8b mid	B	no	abund.	27.4	346	13.8	13.9	5.9	183	0.08	1.00	temperate	humid	3
8b low	B	no	abund.	5.4	208	22.6	8.2	7.0	96	0.09	1.00	cold	humid	3
8b-10	B	no	abund.	20.9	255	27.7	4.4	7.1	105	0.08	0.85	cold	humid	3
10-11	B	yes	abund.	27.6	347	18.0	14.3	2.9	119	0.11	0.91	temperate	humid	3
11-12	B	no	abund.	88.9	522	17.2	11.7	7.3	87	0.10	0.99	temperate	humid	3
?12-13	C1	no	abund.	46.5	395	6.9	6.8	4.7	90	0.10	0.95	temperate	arid	5
13-14	C1	no	spor.	16.5	43	8.2	7.0	6.5	117	0.10	1.00	temperate	arid	5
14-15	C1	no	spor.	3.6	**8**	12.9	**14.4**	**2.1**	142	0.12	1.00	temperate	arid	5
16a up	C1	yes	spor.	19.1	38	12.1	3.7	10.1	59	0.12	1.02	temperate	arid	5
16a low	C1	yes	spor.	4.2	53	9.3	6.7	3.5	65	0.09	1.02	temperate	arid	5
17a1	C1	no	spor.	6.4	32	13.8	5.3	5.2	66	0.12	1.02	temperate	arid	5
17	C1	no	spor.	10.1	45	14.7	6.1	5.3	67	0.11	1.08	temperate	arid	5
17a2 up	C1	no	spor.	18.9	71	11.3	2.1	7.3	79	0.08	1.12	temperate	arid	5
17a2 low	C1	no	spor.	18.1	51	6.6	1.6	7.0	52	0.07	1.10	temperate	arid	5
17a3	C1	no	spor.	18.2	74	5.5	1.3	9.5	53	0.11	1.13	temperate	arid	5
17/18	C2	no	spor.	8.7	27	14.0	4.9	5.0	88	0.08	1.21	temperate	arid	5
18 up	C2	no	spor.	11.7	49	6.3	3.1	6.6	61	0.08	1.20	temperate	arid	5
18 low	C2	no	spor.	9.0	105	6.5	1.0	8.4	47	0.11	1.13	temperate	arid	5
18a	C2	yes	spor.	4.3	26	10.2	2.0	6.6	50	0.10	1.17	temperate	arid	5
19	C2	yes	spor.	3.5	154	7.3	8.9	3.8	132	0.13	1.16	temperate	arid	5
19/20	C2	no	spor.	10.6	82	12.9	6.6	3.6	73	0.13	1.15	temperate	arid	5
20	C2	yes	spor.	12.8	58	3.3	3.1	4.9	97	0.14	1.10	temperate	arid	5
21	C2	no	spor.	13.0	55	7.2	3.3	7.4	74	0.12	1.15	temperate	arid	5
22	C2	yes	spor.	9.9	66	9.0	3.8	5.0	108	0.11	1.09	temperate	arid	5
23	C2	yes	spor.	16.1	80	8.4	2.9	6.0	54	0.12	1.09	temperate	arid	5
Mean				18.9	138	13.9	5.8	6.7	88	0.10	1.07			
±				16.3	143	7.7	4.2	2.6	40	0.02	0.08			

[1] Data in bold are outliers for the facies in multivariate statistical analyses.
Layers: up = upper portion
mid = middle portion
low = lower portion

[2] Occurrences: spor. = sporadic occurrences
abund. = abundant occurrences

[3] Relative mass have been normalized to unit volume.

[4] Averaged volumes have been normalized to account for sample sizes.

The cave periodically sheltered Paleolithic peoples who left behind their artefacts in Layers 21 through 2 (Bastiani *et al.* 2000; Brodar 1999; Turk and Bastiani 2000). Minor short-lived Aurignacian deposits occur in Layer 2, which include four bone or antler points, one of which is a split-based antler point. Lithic artefacts are limited to one atypical tool. Due to the small size of the collection, comparisons with other Upper Paleolithic sites is difficult.

The majority of the deposits, however, contain small Mousterian artefact assemblages (*sensu lato*), with stone Middle Palaeolithic tools, some bone awls, and several fragmented bone points (Figure 11.4; Brodar 1999, Plate 6: 5–7; Turk 2005, Figure 15; http://site.viola.fr/housitzky). The Mousterian stone artefacts are most concentrated in Layers 4 (52–81 pieces) and 10–14 (275 pieces). In several layers, especially Layers 5, 6, 8, 10–13, and 20, well defined hearths are preserved, all with large quantities of charcoal (see above). Tools are relatively abundant, consisting mainly of scrapers and denticulates. All the tools show heavy wear, including fracturing on one or more edges and pointed tips (Bastiani *et al.* 2000). Numerous borers or *becs* were discovered in Layer 8 and deeper layers, many of which show damage that has removed the tip of the *bec* (Figure 11.5). The site is most famous, however, for its "Neanderthal flute" (Figure 11.6; Kunej and Turk 2000; Turk *et al.* 1995a, 2005; see below).

While the 20 hearths (e.g., Figure 11.2b) indicate definite occupation, probably including overnight stays, the low artefact counts (~ 600 pieces) suggest that the visits were limited in duration, and perhaps seasonal or sporadic. Since most of the bears appear to have died during hibernation (Debeljak 2002), humans would not likely have risked using the site during the late fall, winter, or early spring. The large amount of cave bear bone in the site that could be exploited for tools, as well as fat and marrow extraction, may have been the resource that drew people to the site. Unambiguous evidence for human worship of cave bear skulls also occurs during deposition of Layer 8, analogous to the much younger example from Chauvet, France. Evidence for cave bear hunting is sparse and ambiguous (Turk 2003b). Little evidence exists for hunting other animals, especially herbivores.

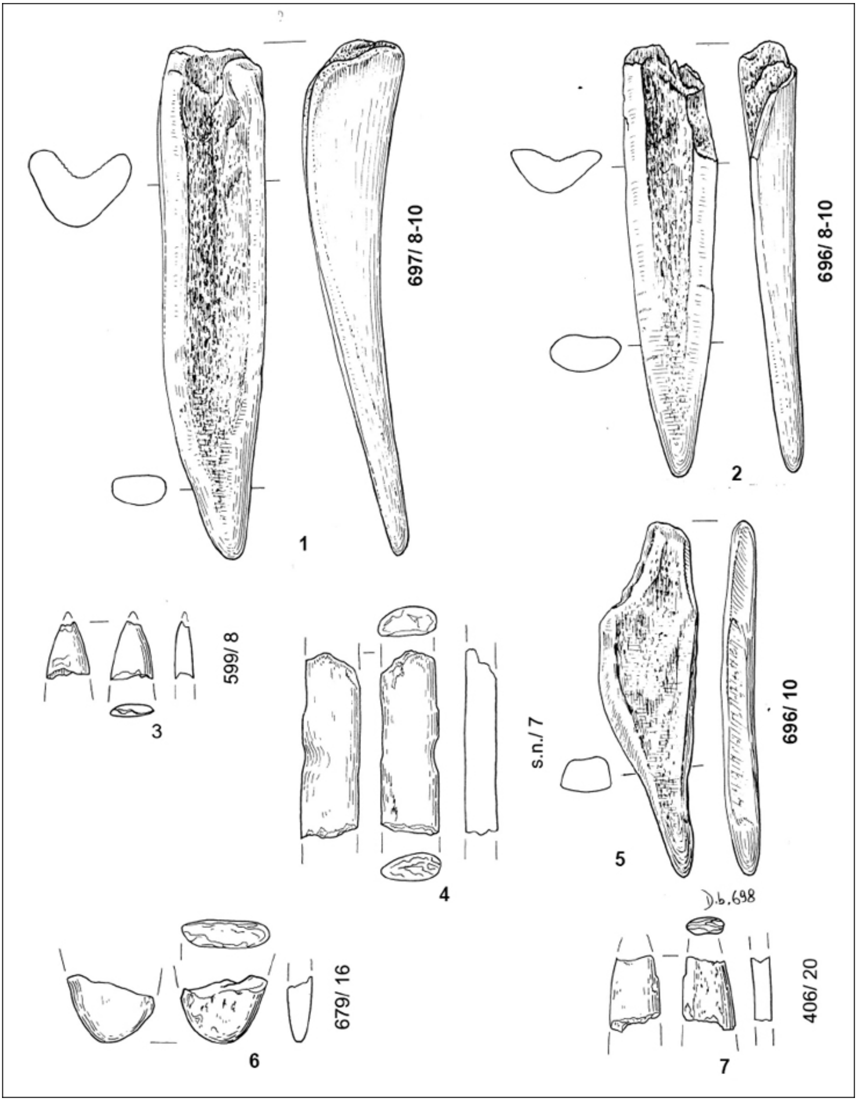
Several ^{14}C dates were attempted on bone and charcoal from the site (Nelson 1997; see corrected ^{14}C dates for Layers 2, 6, and 8 at http://www.esc.cam.ac.uk/oistage3/Secure/arch-dbase.xls). Despite the incredible preservation at Divje Babe I, which preserved even the first cave bear hair ever found, most of the dates attempted exceeded the limits for ^{14}C dating, normally from 40 to 50 ka depending on the material dated. Several others were so close to that limit, that a small amount of modern carbon (C) contamination could have skewed them significantly. Several of the ^{14}C ages also showed no agreement with the stratigraphy. Bone and charcoal are both geochemically adept at uptaking secondary trace elements, including C, various carbonate ions, humic acid residues, etc., which could all have added secondary C or ^{14}C. If the contaminant C derived from the wall rock, it will increase the apparent ^{14}C ages. Should the contaminants contain modern C sources, they will skew the ^{14}C ages to appear too young. Given the uncertainty of the discrepancy between uncalibrated ^{14}C ages and true calendric dates, especially in the 35–50 ka range, correcting ^{14}C ages in this range adds considerable uncertainty to any ^{14}C ages over 25 ka. Recently reported age spikes and other disagreements between the ^{14}C ages and the stratigraphic sequences (e.g., Conard and Bolus 2003; Wrinn *et al.* 2004) mean that ^{14}C dates >

35 ka, at best, merely confirm the antiquity of a site. Among those attempted by Nelson (1997), only the ages for Layer 2, the Aurignacian layer, dated at 35.3 ± 0.7 ky BP, and the bone from Layer 6, dated at 43.3 ± 1.4 ky BP, should be considered reliable. They do, however, suggest that the ESR dates have validity (see below).

Lau *et al.* (1997) reported ESR ages for five teeth ranging from 42 ± 6 ka to 95 ± 11 ka for Layers 13, 17a2, and 20. Because their dates used relatively few sedimentary analyses from a site which contains substantial inhomogeneity in the sedimentary dose rates, their analysis produced inconclusive ages for the layers, although the ages did indicate that they predated the appearance of modern humans in the region. Here, we report the ages for another 21 teeth (Table 11.2) based upon > 190 sedimentary component analyses (Table 11.3) to improve the precision and accuracy of the external dose rate determinations.

The Flute

At 2.85 m depth, approximately 30 cm horizontally from a small hearth in the same horizon (Figure 11.2b), Layer 8a yielded a partial juvenile *Ursus spelaeus* femur with four holes (two now notches) on the posterior, and one notch on the anterior, diaphysis (Figure 11.6). The flute was cemented to the underside of the phosphatic deposits that sealed the top of Layer 8. Although Aurignacian bone points occur in Layer 2 at 0.5 m depth, more than 2 m of unconsolidated sediment separates Layer 2 from the well cemented dolomitic breccia in Layer 8 and parts of 7, which housed the flute. Moreover, more than 1 m of flatly lying deposits with well defined bedding separates Layer 8a from the bottom of the cryoturbation features at the Layer 5a/5 border. Sedimentologically, therefore, it becomes extremely improbable that the perforated juvenile cave bear femur derived from any layer other than the one where it was discovered.


697/ 8-10
1
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2
599/ 8
3
s.n./ 7
4
696/ 10
5
D.b.698
679/ 16
6
406/ 20
7

Figure 11.4. Worked bones from Divje Babe I, Slovenia. Worked bones have been found in several layers, including these from Layers 7, 8–10, 16, and 20. The catalogue number and layer are shown beside the pieces. In the case of Samples 1, 2, and 5, these long bone diaphyses were fractured while still fresh (actual size; adapted from Turk et al. 2005).

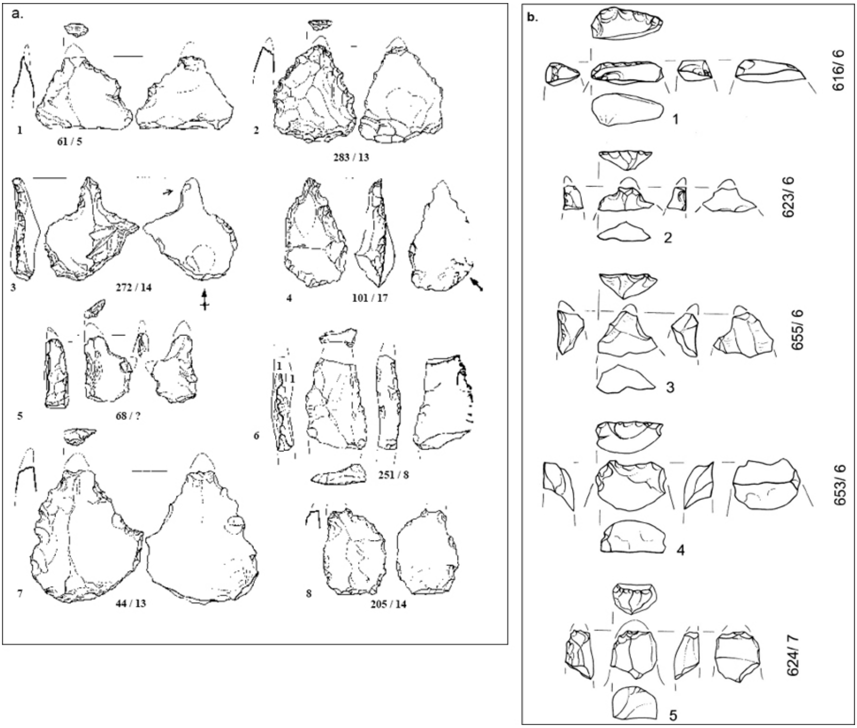
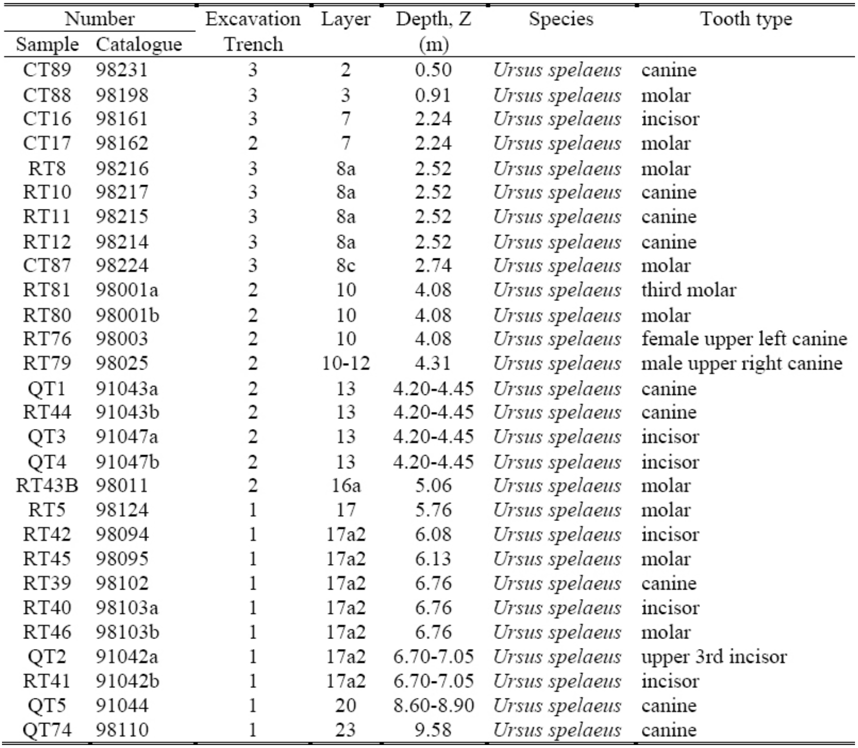


Figure 11.5. Mousterian Tools found in Divje Babe I, Slovenia. Numerous tools suitable for boring bone have been found in the Mousterian layers at Divje Babe I: a. Artefacts 1, 2, 5, 6, 7, 8, all have lost their pointed tips, while Artefact 6 has large flakes broken off during use. Such damage flakes and broken tips typically occur when tools are used to carve bone and wood. Tools 3 and 4, which retain their tips have points ideal for punching bone or wood. The denticulated edges on all the tools also can be used to carve or shave bone and wood. b. Many broken tips, such as those here, can be found in the Mousterian layers. Some, such as 2 and 5, show multiple generations of tip breakage. All are shown at 1:1. The label below or beside the artefact gives its accession number and layer number (adapted from Turk et al. 2001).

Table 11.2. Teeth in the Study



Number		Excavation	Layer	Depth, Z	Species	Tooth type
Sample	Catalogue	Trench		(m)		
CT89	98231	3	2	0.50	*Ursus spelaeus*	canine
CT88	98198	3	3	0.91	*Ursus spelaeus*	molar
CT16	98161	3	7	2.24	*Ursus spelaeus*	incisor
CT17	98162	2	7	2.24	*Ursus spelaeus*	molar
RT8	98216	3	8a	2.52	*Ursus spelaeus*	molar
RT10	98217	3	8a	2.52	*Ursus spelaeus*	canine
RT11	98215	3	8a	2.52	*Ursus spelaeus*	canine
RT12	98214	3	8a	2.52	*Ursus spelaeus*	canine
CT87	98224	3	8c	2.74	*Ursus spelaeus*	molar
RT81	98001a	2	10	4.08	*Ursus spelaeus*	third molar
RT80	98001b	2	10	4.08	*Ursus spelaeus*	molar
RT76	98003	2	10	4.08	*Ursus spelaeus*	female upper left canine
RT79	98025	2	10-12	4.31	*Ursus spelaeus*	male upper right canine
QT1	91043a	2	13	4.20-4.45	*Ursus spelaeus*	canine
RT44	91043b	2	13	4.20-4.45	*Ursus spelaeus*	canine
QT3	91047a	2	13	4.20-4.45	*Ursus spelaeus*	incisor
QT4	91047b	2	13	4.20-4.45	*Ursus spelaeus*	incisor
RT43B	98011	2	16a	5.06	*Ursus spelaeus*	molar
RT5	98124	1	17	5.76	*Ursus spelaeus*	molar
RT42	98094	1	17a2	6.08	*Ursus spelaeus*	incisor
RT45	98095	1	17a2	6.13	*Ursus spelaeus*	molar
RT39	98102	1	17a2	6.76	*Ursus spelaeus*	canine
RT40	98103a	1	17a2	6.76	*Ursus spelaeus*	incisor
RT46	98103b	1	17a2	6.76	*Ursus spelaeus*	molar
QT2	91042a	1	17a2	6.70-7.05	*Ursus spelaeus*	upper 3rd incisor
RT41	91042b	1	17a2	6.70-7.05	*Ursus spelaeus*	incisor
QT5	91044	1	20	8.60-8.90	*Ursus spelaeus*	canine
QT74	98110	1	23	9.58	*Ursus spelaeus*	canine

In a sample of 2932 juvenile diaphyses removed from 95 m^3 of stratified sediment collected from all layers, no pierced bones occurred. Some bones have impressions of teeth at the metaphyses. In the entire sample, only one pierced bone was found, namely a proximal metaphysis of femur, with a etched hole, found in Quadrant 23 at 273 cm depth. We stress this, due to the bitter polemics about the bone flute found in Quadrant 17 at 285 cm depth. Some authors have attempted to explain this as a product of carnivore activity by incorrectly claiming that other pierced bones commonly occur at sites with cave bear remains (e.g., d'Errico *et al.* 2003). Among 89,811 identifiable bones examined from Divje Babe I, only one long bone exists that was pierced more than once, namely the flute (Turk *et al.* 1995a, 1997, 2005), and only one other pierced bone, namely the singly pierced proximal metaphysis. Given the hole's position close to the epiphysis on the singly pierced proximal metaphysis, it may possibly have resulted from carnivore activity. In earlier excavations, other rare pierced bones were also found in Divje Babe I (e.g., Brodar 1999, Table 6: 8, 9; Turk *et al.* 2001a, Table 5, Figure 19). Pierced bones in Divje Babe I are in no sense a general phenomenon, but at best, an exceptional phenomenon. Since the other pierced bones have not received the same detailed scrutiny as the flute, whether they were drilled by humans or bitten by carnivores remains undetermined.

Although some authors (e.g., Nowell and Chase 2000; d'Errico *et al.* 2003) have suggested that the flute resulted from coincidental taphonomic damage to a cave bear femur, more recent investigations of the bone, its holes, and the archaeological process necessary to produce such holes clearly demonstrate that the bone cannot be other than an object created by hominids. Whether it was ever played to produce music is a question that cannot currently be answered scientifically. Nonetheless, its similarity with other artefacts dubbed "flutes" demands it also be so designated.

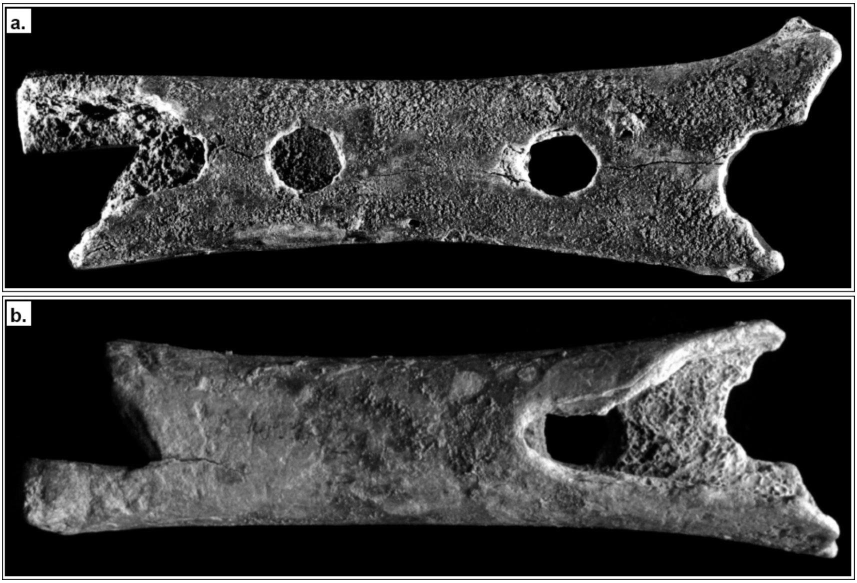
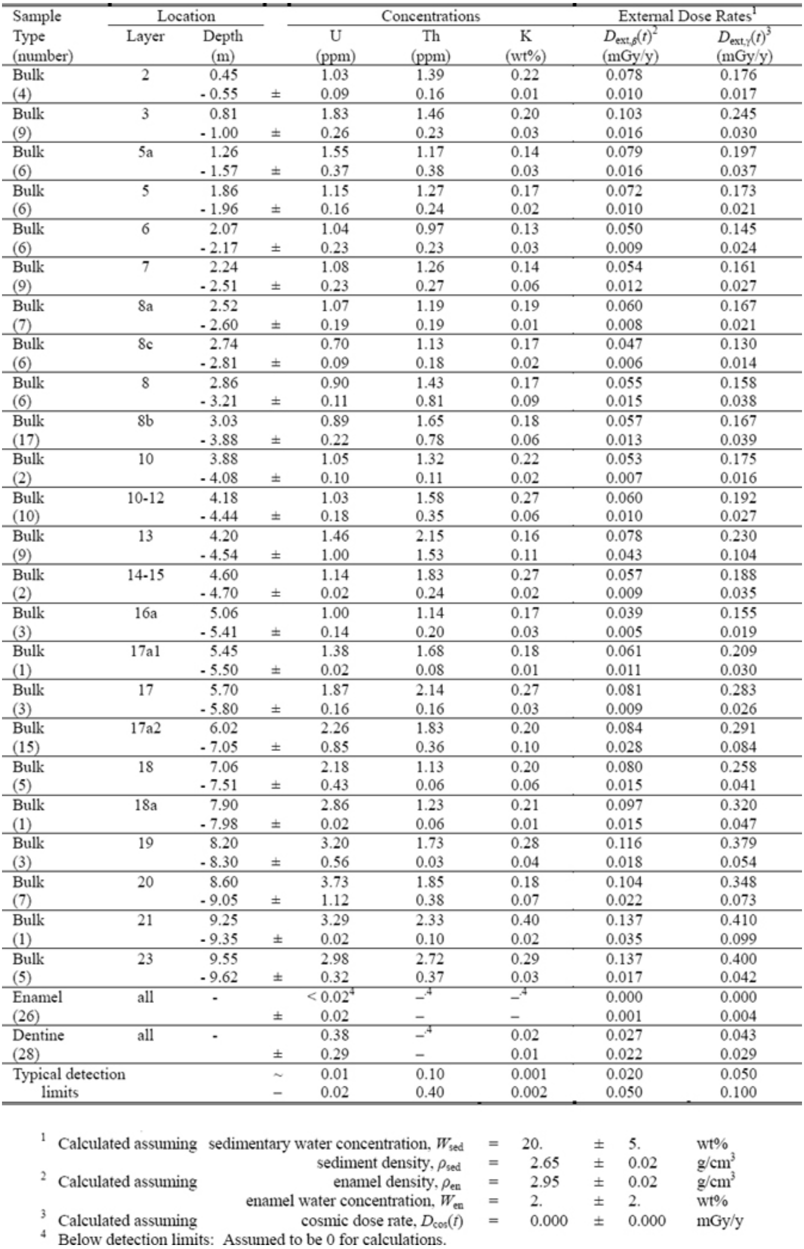


Figure 11.6. The cave bear femur with five holes, Divje Babe I, Slovenia. Found in Layer 8, the juvenile femur has four holes on the posterior side and one on the anterior side: a. The epiphyses and metaphyses have been lost from this bone, probably due to gnawing by a wolf after its abandonment at the site. A crack runs along the posterior side connecting all the holes, but it does not penetrate the entire diaphysis. Another crack runs partially on the anterior side. b. The offset between the two holes that are aligned on opposite sides is approximately 4 mm (adapted from Turk et al. 2005).

The four holes (two now notches) on the posterior side of the juvenile cave bear femur are aligned along the mid-line of the diaphysis with their centres forming a straight line, while on the anterior side, a notch aligns with the first hole on the posterior side. The incredible coincidence required for any animal to be able to place four holes in such precise alignment by biting the bone in itself argues that this must be an archaeological artefact (*contra* Chase and Nowell 2000; d'Errico *et al.* 2003). The two holes and the hole in one notch all on the anterior and the hole at the bottom of the notch on the posterior (opposite) side are well rounded, averaging 9 mm in diameter. The posterior holes all penetrate 4 cm of compact bone, but other than Hole 2, no holes align with any on, or penetrate, the anterior side (for details see Turk *et al.* 2005). More importantly, on the anterior, no marks of any sort can be detected at a position, which would correspond to the spot where a second animal tooth would have damaged the bone (*contra* Chase and Nowell 2000; d'Errico *et al.* 2003). A crack does penetrate from the most distal hole to the third hole, suggesting why the bone may have been abandoned at Divje Babe I during its manufacture or use. The ratio between the distances between the four posterior holes is 1:2:1.75. This spacing on the femur matches that seen in later flutes from the Aurignacian and Gravettian, including the Isturitz bird bone flutes (Buisson 1990; R. White, pers. comm. 1996), the Istállóskő flute, and the Lokve flute (Horusitzky 2003), which range in age from 22 to 34 ka. This striking similarty or possibly, technological conservatism in design, hints that this spacing produces a series of pitches that please the human ear or that make it easier to play pleasingly (Fink 1997).

To test if animals could have produced the holes, as suggested by Chase and Nowell (2000) and d'Errico *et al.* (2003), Turk *et al.* (2001a, 2003) designed jaws to replicate the size, shape, tooth arrangement, and strength of several species that routinely gnaw bone, including wolf, *Hyena*, and cave bears. These were placed in a mechanical press along with green (fresh) juvenile brown bear femurs, the best modern equivalent to fresh cave bear bone, to attempt to measure the jaw strength necessary to penetrate the juvenile cave bear femur. Other than carnassials from *Hyena*, bones from which have not been identified in the faunal remains at Divje Babe I, only the canines in adult cave bears had sufficient strength to punch through the juvenile femur in any location. In all cases, however, the strength necessary to punch through the femur also produced significant, and easily observable, scratches or indentations on the opposite side to the punched hole generated by the opposing canine. Only in the case of Holes 2 and 5 are there holes on both sides, but these are directly opposite each other, with only 3–4 mm of offset (Figure 11.6b; Turk *et al.* 2005). The upper and lower canines from cave bears are offset by at least 10 mm. Moreover, in the experiments, the cave bear canines were only able to produce such holes successfully on the anterior surface, namely on the surface which opposes the surface on which the four holes actually occur on the Divje Babe bone (Turk *et al.* 2003). Attempts with the artificial jaws to produce more than one hole aligned on any fresh femur resulted in the fresh bone cracking or fracturing into pieces too small for further experimentation. Nor are any fossilized bones from caves that were only inhabited by cave bears known to bear more than two oppositely oriented holes punched by canines or any other teeth (Turk *et al.* 2005).

Table 11.3. Sedimentary Geochemistry and Dose Rates at Divje Babe I, Slovenia



Sample	Location			Concentrations			External Dose Rates[1]	
Type	Layer	Depth		U	Th	K	$D_{ext,\beta}(t)$[2]	$D_{ext,\gamma}(t)$[3]
(number)		(m)		(ppm)	(ppm)	(wt%)	(mGy/y)	(mGy/y)
Bulk	2	0.45		1.03	1.39	0.22	0.078	0.176
(4)		- 0.55	±	0.09	0.16	0.01	0.010	0.017
Bulk	3	0.81		1.83	1.46	0.20	0.103	0.245
(9)		- 1.00	±	0.26	0.23	0.03	0.016	0.030
Bulk	5a	1.26		1.55	1.17	0.14	0.079	0.197
(6)		- 1.57	±	0.37	0.38	0.03	0.016	0.037
Bulk	5	1.86		1.15	1.27	0.17	0.072	0.173
(6)		- 1.96	±	0.16	0.24	0.02	0.010	0.021
Bulk	6	2.07		1.04	0.97	0.13	0.050	0.145
(6)		- 2.17	±	0.23	0.23	0.03	0.009	0.024
Bulk	7	2.24		1.08	1.26	0.14	0.054	0.161
(9)		- 2.51	±	0.23	0.27	0.06	0.012	0.027
Bulk	8a	2.52		1.07	1.19	0.19	0.060	0.167
(7)		- 2.60	±	0.19	0.19	0.01	0.008	0.021
Bulk	8c	2.74		0.70	1.13	0.17	0.047	0.130
(6)		- 2.81	±	0.09	0.18	0.02	0.006	0.014
Bulk	8	2.86		0.90	1.43	0.17	0.055	0.158
(6)		- 3.21	±	0.11	0.81	0.09	0.015	0.038
Bulk	8b	3.03		0.89	1.65	0.18	0.057	0.167
(17)		- 3.88	±	0.22	0.78	0.06	0.013	0.039
Bulk	10	3.88		1.05	1.32	0.22	0.053	0.175
(2)		- 4.08	±	0.10	0.11	0.02	0.007	0.016
Bulk	10-12	4.18		1.03	1.58	0.27	0.060	0.192
(10)		- 4.44	±	0.18	0.35	0.06	0.010	0.027
Bulk	13	4.20		1.46	2.15	0.16	0.078	0.230
(9)		- 4.54	±	1.00	1.53	0.11	0.043	0.104
Bulk	14-15	4.60		1.14	1.83	0.27	0.057	0.188
(2)		- 4.70	±	0.02	0.24	0.02	0.009	0.035
Bulk	16a	5.06		1.00	1.14	0.17	0.039	0.155
(3)		- 5.41	±	0.14	0.20	0.03	0.005	0.019
Bulk	17a1	5.45		1.38	1.68	0.18	0.061	0.209
(1)		- 5.50	±	0.02	0.08	0.01	0.011	0.030
Bulk	17	5.70		1.87	2.14	0.27	0.081	0.283
(3)		- 5.80	±	0.16	0.16	0.03	0.009	0.026
Bulk	17a2	6.02		2.26	1.83	0.20	0.084	0.291
(15)		- 7.05	±	0.85	0.36	0.10	0.028	0.084
Bulk	18	7.06		2.18	1.13	0.20	0.080	0.258
(5)		- 7.51	±	0.43	0.06	0.06	0.015	0.041
Bulk	18a	7.90		2.86	1.23	0.21	0.097	0.320
(1)		- 7.98	±	0.02	0.06	0.01	0.015	0.047
Bulk	19	8.20		3.20	1.73	0.28	0.116	0.379
(3)		- 8.30	±	0.56	0.03	0.04	0.018	0.054
Bulk	20	8.60		3.73	1.85	0.18	0.104	0.348
(7)		- 9.05	±	1.12	0.38	0.07	0.022	0.073
Bulk	21	9.25		3.29	2.33	0.40	0.137	0.410
(1)		- 9.35	±	0.02	0.10	0.02	0.035	0.099
Bulk	23	9.55		2.98	2.72	0.29	0.137	0.400
(5)		- 9.62	±	0.32	0.37	0.03	0.017	0.042
Enamel	all	-		< 0.02[4]	–[4]	–[4]	0.000	0.000
(26)			±	0.02	–	–	0.001	0.004
Dentine	all	-		0.38	–[4]	0.02	0.027	0.043
(28)			±	0.29	–	0.01	0.022	0.029
Typical detection limits			~	0.01	0.10	0.001	0.020	0.050
			–	0.02	0.40	0.002	0.050	0.100

[1] Calculated assuming sedimentary water concentration, W_{sed} = 20. ± 5. wt%
sediment density, ρ_{sed} = 2.65 ± 0.02 g/cm^3
[2] Calculated assuming enamel density, ρ_{en} = 2.95 ± 0.02 g/cm^3
enamel water concentration, W_{en} = 2. ± 2. wt%
[3] Calculated assuming cosmic dose rate, $D_{cos}(t)$ = 0.000 ± 0.000 mGy/y
[4] Below detection limits: Assumed to be 0 for calculations.

Computerized tomography showed that carnivore teeth could not have made the four holes (Figure 11.7). Where the holes occur on the posterior diaphysis, the diaphysis is thicker or as thick as anywhere else (Turk *et al.* 1997; *contra* Nowell and Chase 2000). The tomography showed that the bone has been thinned in places. All four holes are actual holes rather than the result of carnivore teeth punching or gnawing on the bone (Turk *et al.* 2005). After the four holes had been created and the piece was abandoned, however, a carnivore, probably a wolf, used its molars to gnaw and fracture the ends of the femur.

The tools found associated with the perforated juvenile femur and in underlying Mousterian levels include the ideal tools for producing its holes, including several examples of *becs* (Figure 11.5a). These pointed tools have damage flakes that resemble those in modern tools used for carving bone or wood. The paired notches on both lateral edges near the point produce sharply pointed "noses" on the tools. The "noses" have basal diameters from 4 to 8 mm on average. What strikes one when examining this collection is how many of these tools show damage which has removed the tip of the nose, breaking it off at the shoulders where it abuts the wider part of the tool (Figure 11.5b; Bastiani and Turk 1997).

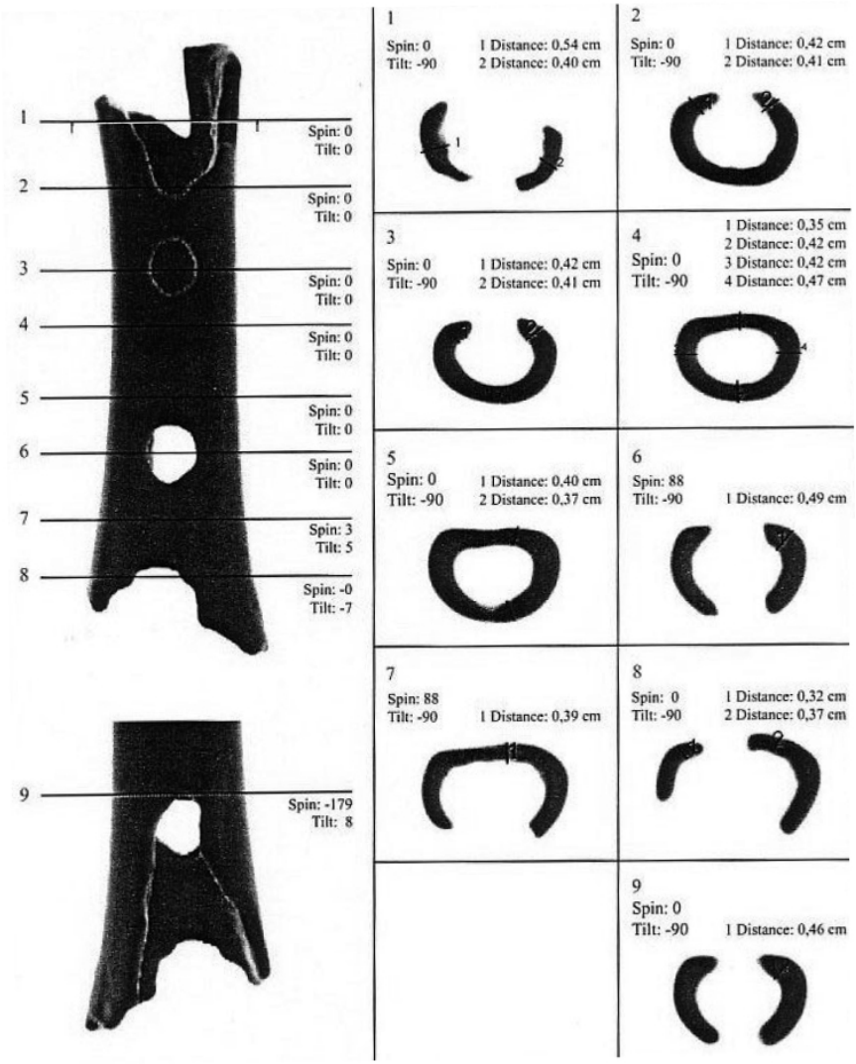
To test the significance of these tools and this damage, Bastiani and Turk (1997) knapped identical tools from equivalent quality chert from outcrops near the site. They then used these tools in a variety of ways, including producing holes in fresh (green) brown bear bone. With some practice, they quickly learned to produce a hole very similar to those in the cave bear femur with two methods: Using a sturdy flint tool held similarly to a leather punch will produce a hole when the tool is hit with a large wooden stick or bone, and rounded by rotating the tool in the hole. Alternatively, with a pointed stone tool, they could make a small depression before punching the bone and rounding the hole with a bone punch. More importantly, these techniques for the nosed tools generated exactly the same type of damage on the modern tools as that seen in the Divje Babe tools: Many of the "noses" broke off the boring or punching tools just at the base of the nose near the shoulders. Meanwhile, the scraping tools developed similar damage flakes to those seen in the Divje Babe I collection (Figure 11.8; Bastiani *et al.* 2000). These experimental holes showed the same type of edgewear on the holes as those preserved on the cave bear femur (Bastiani and Turk 1997). Detailed analysis of the hole edges showed evidence for chiseling on at least one hole (Turk *et al.* 2005, Figure 7), while several other examples of worked bone have been found in other Mousterian layers (Figure 11.4).

How can one reasonably postulate that a cave bear could have, *at random*, managed to produce four holes in the proper positions, perfectly aligned along the posterior surface, with the ideal spacing, that is then used for the next 20 ky as a suitable flute design? Occam's razor demands that the femur be considered a flute, despite its association with Mousterian artefacts and its age, which is consistent with the ages for other Mousterian finds all over Europe.

ESR Dating Analysis

ESR dating can provide chronometric (absolute) dates over a substantial time range, from as young as 0.5 ka to about 5–10 Ma, currently with 2–10% precision, depending on the material dated. ESR's importance in dating Quaternary and Pliocene sites has now been well demonstrated in archaeological contexts, including many sites in the Mediterranean region (e.g., Porat and Ronan 2002; Rink *et al.* 1994, 1995, 1996; see other references in Blackwell 2006), because it provides several advantages over rival methods. ESR can also date fossils with archaeological significance and the sediment enclosing them directly. For example, it can date tooth enamel up to 1–2 Ma, much older than the ^{14}C dating limit (∼

40–50 ka). ESR can also accurately date teeth as young as 5–10 ka, with precisions ranging from 1 to 5%. ESR neither requires a handy volcano to produce datable minerals, like ^{39}Ar/^{40}Ar does, nor clean unaltered speleothem, like ^{230}Th/^{234}U. Unlike the luminescence techniques, TL, OSL, and RL, ESR does not require that signals be completely zeroed, because the signals in teeth at birth are zero. Nor do ESR signals suffer anomalous fading, like some TL and OSL signals.


1
Spin: 0
Tilt: 0
2
Spin: 0
Tilt: 0
3
Spin: 0
Tilt: 0
4
Spin: 0
Tilt: 0
5
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Tilt: 0
6
Spin: 0
Tilt: 0
7
Spin: 3
Tilt: 5
8
Spin: -0
Tilt: -7
9
Spin: -179
Tilt: 8
1
Spin: 0
Tilt: -90
1 Distance: 0,54 cm
2 Distance: 0,40 cm
2
Spin: 0
Tilt: -90
1 Distance: 0,42 cm
2 Distance: 0,41 cm
3
Spin: 0
Tilt: -90
1 Distance: 0,42 cm
2 Distance: 0,41 cm
4
Spin: 0
Tilt: -90
1 Distance: 0,35 cm
2 Distance: 0,42 cm
3 Distance: 0,42 cm
4 Distance: 0,47 cm
5
Spin: 0
Tilt: -90
1 Distance: 0,40 cm
2 Distance: 0,37 cm
6
Spin: 88
Tilt: -90
1 Distance: 0,49 cm
7
Spin: 88
Tilt: -90
1 Distance: 0,39 cm
8
Spin: 0
Tilt: -90
1 Distance: 0,32 cm
2 Distance: 0,37 cm
9
Spin: 0
Tilt: -90
1 Distance: 0,46 cm

Figure 11.7. Computerized tomography of the bored cave bear femur, Divje Babe I, Slovenia. Computerized tomography of the femur shows that none of the holes show the classic funnel shaped indentations that would result from piercing by animal teeth (adapted from Turk et al. 2005).

ESR, like TL and OSL, relies on detecting trapped charges induced by radiation in crystals. When minerals experience natural radiation, they gradually accumulate trapped unpaired electrons and positively charged “holes”, which each produce characteristic ESR signals detectable with an ESR spectrometer. If the ESR signal height (intensity) for a radiation-sensitive signal can be converted into an accumulated dose and the radiation dose rate experienced by the sample during its deposition is known or can be modelled, a date can be calculated.

ESR analysis can date hydroxyapatite (HAP) the mineral in mammalian enamel, because a single radiation-sensitive ESR signal occurs at $g = 2.0018$ in fossil, but not modern, enamel. In HAP, the long ESR signal lifetime, $\tau \sim 10^{19}$ y (Skinner *et al.* 2000) and high sensitivity guarantees its utility over a broad time range. Moreover, grinding, light exposure, or heating to temperatures $< 200°C$ do not easily zero the signal. In mammals, its radiation-sensitivity does not depend on species, but does depend on the crystallinity, which is affected by the animal’s age and health (Skinner *et al.* 2001). In deciduous teeth (i.e., “milk” teeth), poorly crystallized HAP can cause analytical problems. Although signal saturation depends on the sample’s U concentration, saturation in enamel generally does not occur before the tooth is $\sim$ 5 Ma. Teeth ranging from 8 ka to 4.0 Ma have been dated successfully.

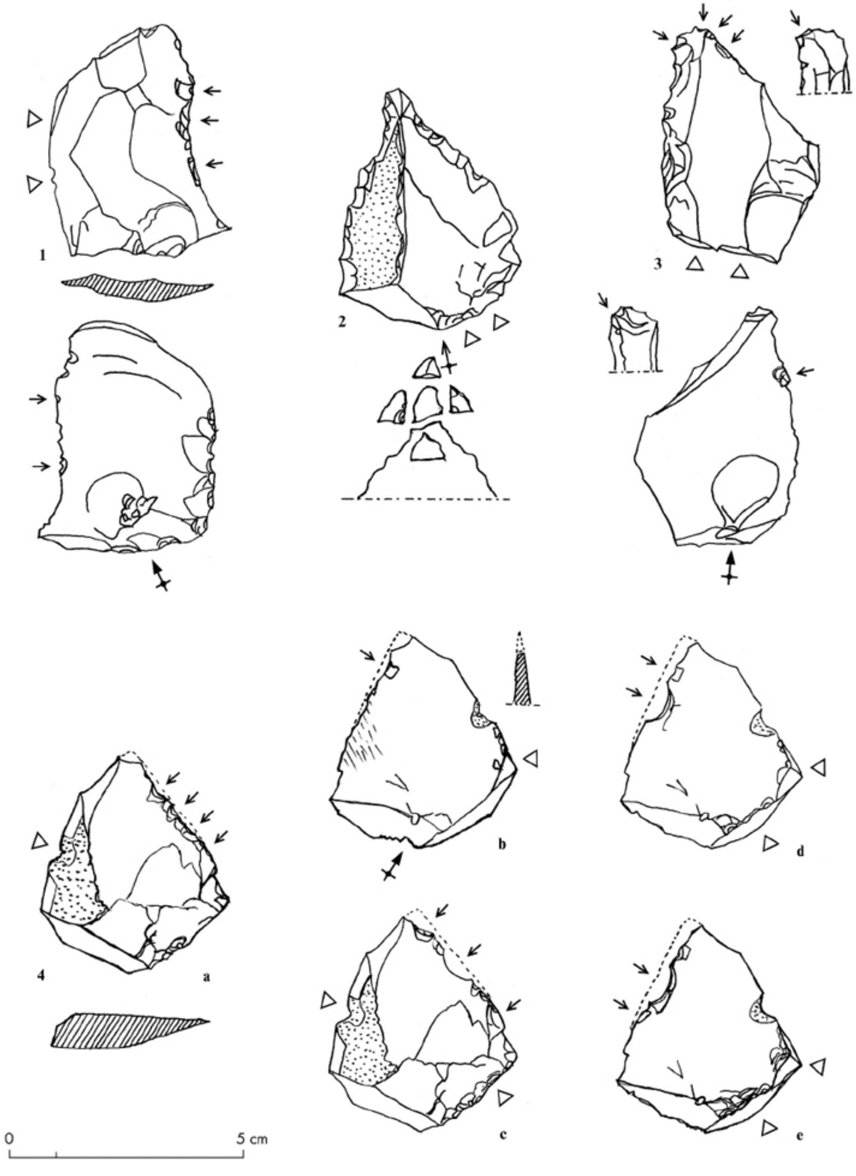

Figure 11.8 Damage typically produced on flint tools during experimental bone working. Triangles indicate damage caused by striking the artefact on the edge with a wooden or bone hammer. Arrows show damage caused by contact between the working edge and a hard material, like bone or hardwood. When scrapers and denticulates are used to work bone in a manner that can produce holes in hardwood or fresh (green) bear bone, damage typically consists of facets on the experimental tools here which were used for scraping or punching bone. Broken tips, like those found in the site (Figure 11.5a), also occurred commonly during the experiment on the tools used to make holes in bone (adapted from Bastiani et al. 2000).

Standard ESR dating (i.e., not isochrons) for tooth enamel has now been tested extensively against other dating methods for sites in the age range 30–300 ka (Blackwell 2001). While standard ESR can still be improved methodologically, such as by fully understanding U uptake, this does not hamper its application, especially in caves such as Divje Babe I, where the dental U concentrations are so low that all the model ages become statistically identical.

The ESR signal height is proportional to the number of trapped charges at that lattice site, and, therefore, to the total radiation dose, $\mathcal{A}_{\Sigma}$, that the material has experienced. The ESR age, t_1, the time that has elapsed since the mineral formed and began to accumulate charges then is calculated from Equation 1:

$$\mathcal{A}_{\Sigma} = \mathcal{A}_{\mathrm{int}} + \mathcal{A}_{\mathrm{ext}} = \int_{t_0}^{t_1} D_{\Sigma}(t)\,\mathrm{d}t = \int_{t_0}^{t_1} \left(D_{\mathrm{int}}(t) + D_{\mathrm{ext}}(t)\right)\mathrm{d}t = (1)$$

where $\mathcal{A}_{\Sigma}$ = the total accumulated dose in the sample,
$\mathcal{A}_{\mathrm{int}}$ = the internally derived accumulated dose component,
$\mathcal{A}_{\mathrm{ext}}$ = the externally derived accumulated dose component,
$D_{\Sigma}(t)$ = the total dose rate,
$D_{\mathrm{int}}(t)$ = the total dose rate from internal sources: U, its daughters, and any other radioisotopes,
$D_{\mathrm{ext}}(t)$ = the total dose rate from the external environment: sedimentary U, Th, and K, and cosmic dose,
t_1 = the sample's age,
t_0 = today.

Calculating an ESR age requires considering some 30 different parameters, which affect the accumulated dose, the internal and external dose rates.

For each sample, the accumulated dose, $\mathcal{A}_{\Sigma}$, is determined using the additive dose method (Figure 11.9). Generally, $\mathcal{A}_{\Sigma}$ can be measured with 0.8 to 5% precision depending on the spectrometer's calibration (Nagy 2000), the radiation source calibration (Wieser *et al.* 2005), the sample's age and diagenetic state (e.g., Blackwell *et al.* 2005).

To calculate the internal dose rate, $D_{\mathrm{int}}(t)$, the radiation sources (all U, Th, K, etc.) within the sample are measured, usually using neutron activation analysis (NAA) or any geochemical technique able to measure elemental concentrations at the ppm-ppb range. Then, $D_{\mathrm{int}}(t)$ is derived from theoretical calculations. Unlike teeth which contain substantial U, those with very low U concentrations do not require U uptake measurement or modelling to assess a single unique ESR age. Low U concentrations in the teeth also reduce the need to consider radiation attenuation by water within the sample, α and β dose attenuation due to mineral density, radon (Rn) loss, U leaching or secondary U uptake for the $D_{\mathrm{int}}(t)$ calculations (e.g., Blackwell *et al.* 2002, 2007; Brennan *et al.* 2000).

The external dose rate, $D_{\mathrm{ext}}(t)$, strongly affects the calculated ESR ages, especially for samples with low internal dose rates, $D_{\mathrm{int}}(t)$, as at Divje Babe I. To derive the external dose rates, $D_{\mathrm{ext}}(t)$, bulk geochemical analysis by NAA, using powdered sediment collected in conjunction with the sample was analyzed to measure the U, Th, and K concentrations. The radioisotopic concentrations were used to mathematically calculate the current dose rates, $D_{\mathrm{ext},\beta}(t_0)$ and $D_{\mathrm{ext},\gamma}(t_0)$, whose calculation includes corrections for β and γ dose attenuation due to mineral density, water concentration, and backscattering. At sites with very inhomogeneous sediment units ("lumpy" sites), such as Divje Babe I, the inhomogeneity in the dose field requires volumetric analysis (Brennan *et al.* 1997a; Guibert *et al.* 1998): The contribution from each component is averaged depending on its volumetric abundance and radiation output, in order to calculate the actual contribution to $D_{ext}(t)$ from different components or layers within the β and γ "spheres of influence" (e.g., Figure 11.10; Table 11.3). In caves where the bones and teeth contain little or no U, as here at Divje Babe I, $D_{ext}(t)$ calculations do not need to consider possible U uptake, U daughter isotope ingrowth, and potential Rn loss (Blackwell and Blickstein 2000). In caves such as Divje Babe I, $D_{cos}(t)$, the cosmic dose rate, can be assumed to be 0 mGy/y, because the cave is roofed by > 10 m of limestone. Due to their small size, the isochron method could not be performed on any teeth dated from Divje Babe I.

ESR Analytical Method

Using neutron activation analysis (NAA), 140 sediment, 26 enamel, and 28 dentine samples (Table 11.3) were analyzed for sediment dosimetry (Blackwell 1989). To derive $D_{ext}(t)$, bulk geochemical analysis of a powdered sediment sample collected in conjunction with the sample was used to measure the U, Th, and K. More sediment samples were collected from new excavations completed in summer, 1999, to assess $D_{ext}(t)$ in any sedimentary component or layer which may have contributed to the sample's $D_{ext}(t)$ that had not been collected initially with the samples (Blackwell and Blickstein 2000). At the same time, the volume of *éboulis* and aggregates were measured. These samples were then examined to assess paleohumidity and temperature (see below).

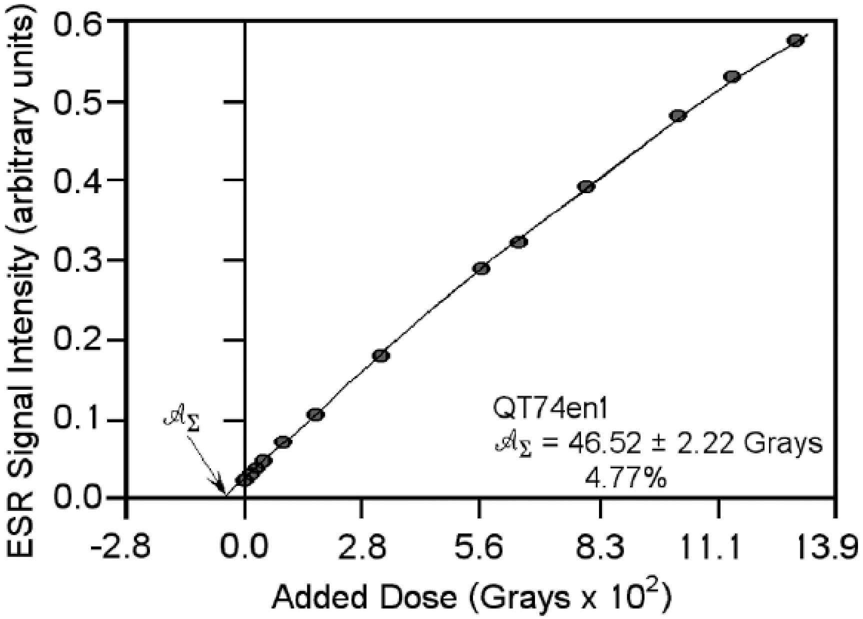

Figure 11.9. Determining the accumulated dose, $\mathscr{A}_\Sigma$. The additive dose method was used to calculate the accumulated (or γ-equivalent) dose, $\mathscr{A}_\Sigma$. After artificially irradiating all but one

aliquot, plotting the signal intensity versus the added radiation dose gave a growth curve, whose x-intercept yielded $\mathscr{A}_{\Sigma}$*. In this bear tooth from Divje Babe, almost no accumulated dose can be detected, thanks to the very low U concentrations in the teeth.*

Using ESR, 42 subsamples from 28 individual teeth collected from Divje Babe I were dated (Table 11.2). Enamel subsamples were prepared following the techniques outlined by Blackwell (1989, 2001) and Blackwell *et al.* (1992, 2000) with minor modifications. To retain a visual record of the teeth after their destruction, each was sketched and photographed from 4–6 different perspectives. Any attached sediment was removed and saved for NAA. Enamel, dentine, any dental cementum, and root thicknesses were measured using a hand-held digital caliper, before using a hand-held, diamond-tipped Dremel drill to remove 1–4 enamel subsamples showing minimal diagenetic alteration. For each subsample, the enamel was separated from the dentine, which was saved for NAA. After primary cleaning to remove any remaining dentine and impurities, and again following secondary cleaning to remove the outer 20 μm affected by α irradiation from each side of the enamel, the thickness of each enamel piece was measured using a Mitutoyo ID-C112E micrometer for 20–50 points on each subsample. After hand powdering to ~ 38–76 μm (200–400 mesh) with an agate mortar and pestle, approximately 20 mg of enamel was weighed into each of 10–15 aliquots.

After the aliquots were irradiated with ^{60}Co γ radiation with added doses ranging from 0.0 to 2.6 kGy at dose rates of 14–126 Gy/s at the McMaster Nuclear Reactor, each was annealed at 90°C for 3.0 days to remove any unstable signal interference (Skinner *et al.* 2000). Spectra were measured using a JEOL RE1X ESR spectrometer at room temperature, with a microwave frequency of 9.449 GHz at 2.0 mW power under a 100 kHz field with a modulation amplitude of 0.5 mT. Spectra were collected electronically using EPRware, by scanning over a 5.0 mT width centered at 338.5 mT at an 8.0 minute sweep time and a 0.1 s time constant, with variable gains depending on the signal intensity.

For several teeth with extremely small enamel masses, the ramping technique was used (Blackwell 2001). With only 3–8 aliquots, 1–4 aliquots were used to calibrate the ESR spectrometer with each set of remeasurements, and 1–5 were successively reirradiated to ever higher added doses and then remeasured with the ESR after each dose (Blackwell, 2001). This was repeated until at least 12–15 independent added doses were measured, with the maximum added dose at least 10 times that of the accumulated dose to ensure the best precision for the growth curves (Grün 1996; Lee *et al.* 1997).

Each enamel, dentine, and sediment subsample was powdered and analyzed for U using NAA (e.g., Tables 11.3, 11.4). About 0.5–1.0 g of each were counted by delayed neutron counting for 60 s after a 60 s irradiation and 10 s delay. All sediment subsamples, and at least one enamel and dentine subsample per tooth were analyzed for Th, K, and 12 other elements by γ counting for 20 minutes. K was analyzed after a 60 s irradiation and a 24 hour delay. Th was irradiated for 1 hour, and counted following a 7–10 day delay. Each NAA data set was calibrated to a NIST standard, usually 1633A or 1633B.

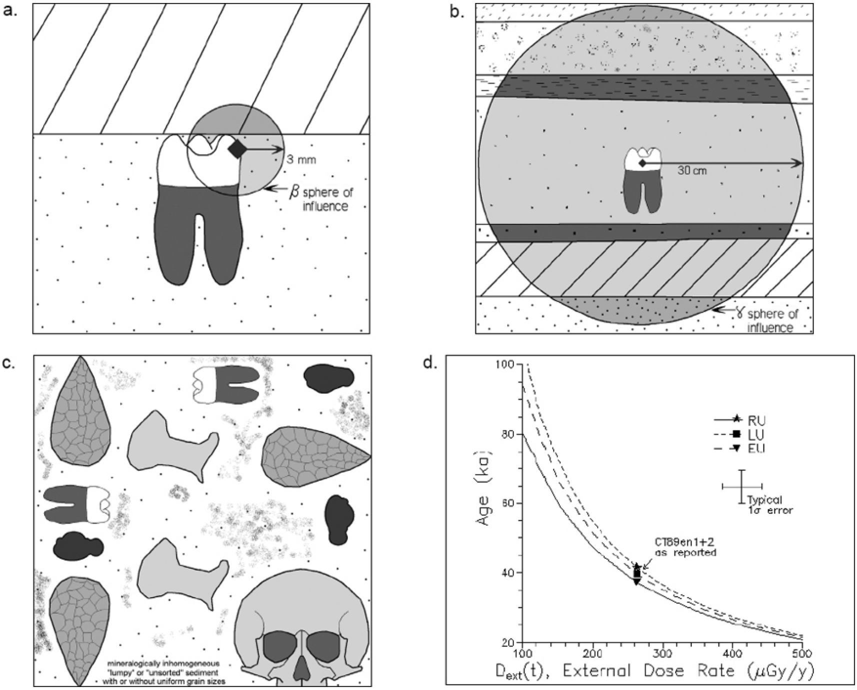
a.
3 mm
β sphere of influence
b.
30 cm
γ sphere of influence
c.
mineralogically inhomogeneous "lumpy" or "unsorted" sediment with or without uniform grain sizes
d.
100
80
60
40
20
Age (ka)
100
200
300
400
500
D_ext(t), External Dose Rate (µGy/y)
RU
LU
EU
Typical 1σ error
CT89en1+2 as reported

Figure 11.10. Determining the external dose rate, $D_{ext}(t)$. Radiation can reach the dating sample from radioactive decay occurring within the sphere of influence for the particular radiation type: a. β particles deliver to a sample a significant, but variable, component in the total radiation dose, both externally and internally. Since the penetration range for a β particle averages 1–2 mm, comparable to the sample thicknesses, dose calculations must consider β attenuation within the sample. The sphere of influence for the contributions from β radiation will usually not include more than two or three sedimentary units. b. Since γ irradiation can penetrate ~ 30 cm, the sphere of influence for the contributions from γ radiation can include several sedimentary units and several different sedimentary components, which may produce very different dose rates, c. In "lumpy" sites such as Divje Babe I, different minerals or clasts within the inhomogeneous sediment may contain different concentrations of radioactive elements. Each lump can contribute a different dose rate. At Divje Babe I, the "lumps" are bones, teeth, and dolomitic rock from the cave roof. d. As $D_{ext}(t)$, the external dose rate, decreases the calculated age, t_1, increases for CT89en1 + 2. The difference in its calculated age becomes statistically significant, only if the external dose rate actually experienced by the tooth exceeded 400 µGy/y, or fell below 190 µGy/y. In all situations, $D_{ext}(t)$ calculations must volumetrically average the dose rate from layer or mineralogical component (i.e., éboulis) relative to its importance and location within the sphere of influence around the tooth.

Analytical Calculations for ESR Dates

Despite calls for much more complex measurement protocols (e.g., Vanhaelewyn *et al.* 2000), Q band tests have indicated that, although the HAP peak in teeth contains two components, both grow uniformly and can be accurately measured by a simple peak height measurement without spectral deconvolution to split the peak's components, because the component peaks actually derive from the same lattice site in the enamel (Skinner *et al.* 2000). Derivative ESR spectra actually provide better statistical resolution than integrated spectra (Lyons and Tan 2000). Therefore, peak heights were measured directly from the derivative spectra using EPRware without spectral deconvolution. The accumulated doses, $\mathscr{A}_{\Sigma}$, and their associated errors were calculated using VFit (Figure 11.9), assuming a saturating exponential regression with $1/I^2$ weighting.

Table 11.4. U Concentrations in the Teeth from Divje Babe I, Slovenia

Sample (number)	Layer		Mean U Concentrations Enamel (ppm)	Dentine (ppm)	Dentine in Root (ppm)	Cementum (ppm)
CT89	2		< 0.02^1	0.84	0.77	–
(1)		±	0.02	0.02	0.02	–
CT88	3		0.06	1.18	2.21	–
(2)		±	0.06	0.17	0.02	–
CT16	3		< 0.02^1	0.44	–	–
(1)		±	0.02	0.02	–	–
CT17	3		< 0.02^1	0.06	–	–
(2)		±	0.02	0.02	–	–
RT8	8a		0.05	0.41	–	–
(3)		±	0.03	0.02	–	–
RT10	8a		< 0.02	0.13	–	–
(1)		±	0.02	0.02	–	–
RT11	8a		0.01	0.16	–	–
(1)		±	0.02	0.02	–	–
RT12	8a		0.10	0.17	0.53	–
(1)		±	0.02	0.02	0.02	–
CT87	8c		< 0.02^1	0.21	0.35	–
(2)		±	0.02	0.04	0.02	–
RT81	10		< 0.02^1	0.29	–	–
(4)		±	0.02	0.06	–	–
RT80	10		0.08	0.25	0.39	–
(4)		±	0.02	0.12	0.20	–
RT76	10		< 0.01^1	0.31	0.76	–
(3)		±	0.02	0.05	0.04	–
RT79	10		< 0.01^1	0.13	0.66	–
(2)	– 12	±	0.02	0.02	0.25	–
QT1	13		< 0.02^1	0.20	0.72	–
(4)		±	0.02	0.07	0.20	–
RT44	13		–	0.30	–	–
(1)		±	–	0.02	–	–
QT3	13		0.05	0.12	0.66	–
(3)		±	0.04	0.02	0.02	–
QT4	13		0.05	0.13	0.21	–
(5)		±	0.02	0.03	0.08	–
RT43B	16a		< 0.02^1	0.57	0.29	–
(3)		±	0.02	0.10	0.17	–
RT5	17		< 0.02^1	0.28	0.31	–
(2)		±	0.02	0.16	0.02	–
RT42	17a2		< 0.02^1	0.83	1.76	–
(2)		±	0.02	0.02	0.02	–
RT45	17a2		< 0.02^1	1.02	–	–
(2)		±	0.02	0.03	–	–
RT39	17a2		< 0.02^1	0.78	0.74	–
(1)		±	0.02	0.02	0.02	–
RT40	17a2		< 0.02^1	0.57	0.29	–
(2)		±	0.02	0.10	0.17	–
RT46	17a2		< 0.02^1	0.15	0.58	–
(3)		±	0.02	0.02	0.08	–
QT2	17a2		0.07	0.19	0.54	–
(2)		±	0.03	0.07	0.02	–
RT42	17a2		< 0.02^1	0.25	2.37	–
(2)		±	0.02	0.14	0.02	–
QT5	20		< 0.02^1	0.25	0.36	0.64
(4)		±	0.02	0.14	0.03	0.04
QT74	23		< 0.02^1	0.36	–	–
(2)		±	0.02	0.02	–	–
Typical detection limits^2		~ –	0.01 0.02	0.01 0.02	0.01 0.02	0.01 0.02
Typical water concentrations		~ ±	0.02 0.02	0.05 0.02	0.05 0.02	0.05 0.02

[1] Below detection limits: Assumed to equal 0 for calculations.

[2] Typical detection limits depend tissue type and subsample mass.

Ages, dose rates, and their associated errors were calculated using Rosy (Brennan *et al.* 1997b), which considers α and β dose attenuation due to mineral density, composition, initial and final tissue thickness. The internal dose rates were calculated by assuming no Rn loss, no U leaching, an α efficiency for the enamel of

0.15 ± 0.02 and an initial U ratio, $(^{234}U/^{238}U)_0 = 1.2 \pm 0.2$. The major uncertainty in the age calculation stems from uncertainties in $D_{ext}(t)$ and $\mathscr{A}_{\Sigma}$ (Blackwell 2001). For the RU model calculations, the uptake parameter, p, was set to maximize recent uptake, $p = 10$ (Blackwell *et al.* 2000). Where more than one subsample was dated per tooth, or for layers where more than one tooth was dated, weighted mean ages were calculated, after ensuring that no statistical outliers were present. The irradiation source at McMaster was calibrated in the 1992 interlaboratory calibration (Barabas *et al.* 1993), while the ESR lab at Williams participated in the 1992 and 2003–2004 Interlaboratory Calibrations (Wieser *et al.* 2005).

At Divje Babe I, the inhomogeneous sediment contains many sedimentary elements, including bones, teeth, weathered dolomitic *éboulis*, weathered calcitic tufa, lithic artefacts, detrital sediment from carbonate dissolution, detrital dolomite particles ranging in size from clay to sand and secondary phosphate deposits. Each component had different radioactive element concentrations, thereby producing different radiation doses (e.g., Figure 11.10; Table 11.3). For each layer within 30 cm of the dated teeth, several bulk sediment samples and individual sedimentary components (i.e., the "lumps") were analyzed (Table 11.3). $D_{ext}(t)$ were calculated from the U, Th, and K concentrations determined by NAA (e.g., Adamiec and Aitken 1998), assuming no cosmic dose rate contribution. Current water concentrations in the site averaged ~ 10–15 wt% due to the excellent drainage in the site, but calculations assumed 20 ± 5 wt% water, because authigenic phosphatic cements suggest sporadically waterlogged conditions in the past, while the high percentages of corrosion on clasts in some layers argue for significantly wetter conditions than at present. The congelifraction features also argue for the presence of water, either solid or liquid, during the glacial events. Water and ice both attenuate radiation. Relative component composition and void percentages were estimated from detailed stratigraphic profiles and photographs for each sampling location. These were confirmed by using the same process for new outcrops followed by actual volumetric measurements of the different components. The relative contributions from the different sources were volumetrically averaged over the "sphere of influence" for the γ sources using a 30 cm radius (Figure 11.10b), and for the β sources with a 3 mm radius (e.g., Figure 11.10a; Blackwell *et al.* 2000; Blackwell and Blickstein 2000; Brennan *et al.* 1997a). Volumetric averages considered layer thicknesses in the vicinity of the tooth, distance from the tooth, as well as mineralogy and inhomogeneity.

ESR Dating Results

Using ESR, 42 subsamples from 28 teeth from Divje Babe I were independently dated (Table 11.2). For each, several enamel and dentine subsamples were analyzed to assess their U concentrations (Table 11.4). Where sufficient dental cementum could be found to analyze, it was also tested. Because the teeth at Divje Babe usually occurred in pockets or in an intact jaw with several teeth near each other, several samples of root dentine were also collected to assess the external β dose component, $D_{ext,\beta}(t)$ (Table 11.3). For several teeth, at least one enamel and one dentine were also analyzed for Th and K. With very few exceptions, the enamels contained no measurable U. While most dentine in the crowns contained < 0.5 ppm, the root dentine usually contained somewhat more U, but none contained more than 2.5 ppm. No dentine or enamel sample showed any measurable Th nor did any show K > 0.02 wt%, but the bones did show somewhat higher U (2–3 ppm), minor Th, and K (Table 11.3). These data mean that the calculated ages agree within experimental uncertainty regardless of the U uptake model. Moreover, scenarios about how to deal with Rn loss or secondary U uptake become unnecessary, since these also become unimportant sources of uncertainty. Therefore, henceforth, the discussion will focus on the LU ages only, since these provide a median age.

Thanks to the low U concentrations and, hence, the low internal dose rates, $D_{\mathrm{int}}(t)$, the ages do depend strongly on $\mathrm{D}_{\mathrm{ext},\gamma}(t)$. Using neutron activation analysis (NAA), 140 sediment samples (Table 11.3) and several enamels and dentines were analyzed for sediment dosimetry (Blackwell 1989). For most of the layers, the mean $D_{\mathrm{ext},\beta}(t)$ averaged < 100 μGy/y, while the mean $D_{\mathrm{ext},\gamma}(t)$ ranged from 130 to 410 μGy/y. These low values derived from the high concentrations of dolomite particles of all sizes in the sediment (Turk *et al.* 1989, 2001b, 2002), which contain very little U, Th, and K on average. Pure dolomite wall rock averaged < 100 μGy/y. Bones and phosphate deposits, however, contain somewhat higher U concentrations, but still have little Th or K, producing $D_{\mathrm{ext},\gamma}(t)$ from 250 to 300 μGy/y. Unfortunately, the inhomogeneous nature of many layers (Figure 11.2) means that the $D_{\mathrm{ext},\gamma}(t)$ value for any individual tooth often had a large associated uncertainty (Table 11.5), which in turn, caused larger uncertainties in the calculated ESR ages. As $D_{\mathrm{ext}}(t)$, increases the calculated age, t_1, decreases. For all the teeth, however, the difference in their calculated ages does not differ significantly considering the 2 σ uncertainties, unless the external dose rate actually experienced by the teeth differed by more than 100–150 μGy/y from $D_{\mathrm{ext}}(t)$ used here (e.g., Figure 11.10d). Since $D_{\mathrm{ext}}(t)$ here were based on such extensive analyses, such an error is unlikely except for the teeth touching large *éboulis* blocks. The large errors associated with $D_{\mathrm{ext}}(t)$ also ensure no possible change in the sediment water concentration can produce any significant change in the calculated ages.

Given the small teeth dated here, all *Ursus spelaeus* teeth, none yielded more than three subsamples, and several teeth, only one (Table 11.5). For several very small subsamples, irradiation ramping (Blackwell 2001) was necessary to obtain sufficient aliquots to measure an accumulated dose. Since ramping uses only 3–8 aliquots and multiple reirradiations, this procedure resulted in much longer analytical times, as well as higher associated uncertainties in the accumulated doses for the teeth ramped. Consequently, all those teeth have higher uncertainties in their ages, ranging from 7% to 30%, rather than the typical 2–8% uncertainty when dating large ungulate teeth. Otherwise, the accumulated doses had very small uncertainties, averaging from 1 to 5%.

The ages, however, showed internal consistency when plotted stratigraphically (Table 11.5; Figure 11.11). Ranging from 40 ± 5 ka to 50 ± 6 ka for Layers 2–7, the ESR ages agree within their uncertainties with the ^{14}C ages for Layers 2 and 6 at 35.3 ± 0.7 and 43.3 ± 1.4 ky BP respectively. Nonetheless, the consistent offset suggests that, at this age range, the calibration between the ^{14}C ages and calendric ages may average ∼ 3 ky.

In the uncemented part of Layer 8a, ∼ 30 cm above the well cemented portion which yielded the flute, five analyses averaged 59 ± 3 ka (Table 11.5; Figure

11.11), while in Layer 8c at the same depth as the flute, CT87 yielded an age of 54 ± 7 ka. In Layer 10, 1.2 m below the flute, three teeth averaged 67 ± 4 ka, and in Layer 10–12, RT79 averaged 70 ± 13 ka. These dates consistently show that the flute probably dates to about 60 ka.

In Layer 13, three teeth yielded a mean age of 80 ± 8 ka, while RT43B from Layer 16a is 80 ± 7 ka (Table 11.5; Figure 11.11). From Layer 17, RT5 averaged 83 ± 10 ka. Dates for Layer 17a2 ranged from a mean of 80 ± 13 ka at 6.1 m to 102 ± 11 ka at 6.8 m, suggesting continuous and rapid deposition during this period. In Layer 20, QT5 averaged 111 ± 15 ka, while QT74 in Layer 23 averaged 116 ± 12 ka. Thus, deposition in the cave continued throughout most of OIS 5.

The dates suggest that four sedimentation cycles exist in Layers 2 to 23. Sedimentation appears to have been continuous from the initiation of Layer 23 at about 116 ka until approximately 102 ka when the lower part of Layer 17a2 was deposited. This deposition rate averages 0.02 cm/y, which seems high, but not in a cave actively inhabited by either humans or bears, who carry in sediment as they enter and who leave behind large masses of bone. This sequence in Layers 17a2 to 23 correlates well with OIS 5d. Then, a hiatus in sedimentation or a drastic decrease in the sedimentation rate appears to have lasted until about 85 ka when sedimentation resumed again or its rate returned to the levels seen during OIS 5d. From approximately 85 ka (the top of Layer 17a2) until 80 ka (the top of Layer 13), the sedimentation rate averages 0.036 cm/y. This sedimentation cycle corresponds to OIS 5a, Dansgaard-Oeschger Event 21. Another hiatus then followed, that lasted until about 70 ka, which corresponds to first cold phase in OIS 4, but a time that further north saw rapid extreme climatic oscillations (Barron *et al.* 2003). Rapid deposition at approximately 0.012 cm/y resumed, with Layers 10–12 through 8a, from about 70 to 55 ka, a period that correlates with most of OIS 4 and matches a somewhat warmer phase in the pollen records seen at Castiglione, Italy (van Andel 2003), but further north appears to have been cold. Sedimentation slowed or may have stopped briefly from 55 until 50 ka. This corresponds to early OIS 3 and correlates well with recent dates for the cold phase between the Ørel and Glinde-Moerschoofd Events in northern Europe and the short phase at Castiglione with low arboreal pollen (van Andel *et al.* 2003). From about 50 to 40 ka, sedimentation began again, depositing Layers 7 to 2, at a mean rate of about 0.04 cm/y. This period correlates with a warmer phase in mid OIS 3, the Moershoofd-Glinde and Hengelo Interstadials in Northern Europe, and the Dansgaard-Oeschger Events 14–10 (Huntley and Allen 2003).

Table 11.5. ESR Dates for Divje Babe I, Slovenia.

Sample			Accumulated	External Dose Rates		ESR Ages[1]		
(number of	Layer		Dose, $\mathcal{A}_{\Sigma}$	$D_{\beta,\mathrm{ext}}(t)$[2]	$D_{\gamma,\mathrm{ext}}(t)$[2]	EU	LU	RU[3]
analyses)			(Grays)	(μGy/y)	(μGy/y)	(ka)	(ka)	(ka)
CT89	2		11.06	79.1	183.8	37.4	39.7	41.6
(1)		±	0.65	10.5	18.5	4.3	4.7	5.2
CT88	3		12.24	91.3	218.1	34.8	37.3	39.2
(2)		±	0.42	13.9	26.0	3.0	3.5	3.8
CT16	7		11.78	56.5	160.0	51.9	53.2	54.2
(1)		±	0.78	10.6	24.0	8.7	9.1	9.4
CT17	7		7.50	5.5	160.0	46.9	47.1	47.2
(2)		±	0.74	1.6	24.0	6.8	6.8	6.9
Mean Layer	7					49.0	49.6	50.1
(3)		±				5.4	5.5	5.6
						11.0%	11.1%	11.2%
RT8	8a		14.15	73.5	197.9	61.3	64.2	66.5
(3)		±	0.36	10.5	22.5	4.5	4.8	5.2
RT10	8a		15.41	73.5	197.9	50.0	53.1	55.7
(1)		±	1.45	10.5	22.5	7.4	8.0	8.6
RT11	8a		9.61[4]	73.5	197.9	34.3	34.6	34.8
(1)		±	1.84	10.5	22.5	7.8	7.9	8.0
RT12	8a		15.54	73.5	197.9	50.0	53.3	55.8
(1)		±	1.01	10.5	22.5	6.4	7.1	7.7
Mean Layer	8a					55.8	58.6	60.8
(4)		±				3.2	3.4	3.6
						5.7%	5.8%	5.9%
CT87	8c		8.23	6.3	158.9	52.8	54.4	55.6
(1)		±	0.44	1.9	19.9	7.1	7.4	7.8
RT81	10		11.49	39.7	191.3	64.9	67.3	70.3
(2)		±	0.28	7.2	25.9	6.3	6.7	6.8
RT80	10		13.40	68.1	191.3	61.1	65.7	69.0
(2)		±	0.41	11.7	25.9	5.6	6.3	6.9
RT76	10		18.93	68.1	191.3	67.6	70.3	72.5
(1)		±	1.13	11.7	25.9	10.0	10.8	11.4
Mean Layer	10					63.7	67.1	72.3
(5)		±				3.9	4.2	4.5
						6.1%	6.3%	6.3%
RT79	10-12		22.68	74.2	208.6	62.7	69.8	74.5
(2)		±	0.45	25.7	58.9	10.4	13.0	15.3
QT3	13		16.04	7.5	201.3	79.3	84.9	88.9
(3)		±	0.24	2.3	55.2	11.2	12.8	14.1
QT4	13		15.61	7.5	201.3	71.5	74.8	77.1
(2)		±	0.50	2.3	55.2	12.9	14.1	15.0
QT1	13		15.14	7.5	201.3	68.5	71.4	73.7
(2)		±	0.49	2.3	55.2	13.9	15.0	15.9
Mean Layer	13					74.5	78.7	81.6
(7)		±				7.3	8.1	8.7
						9.8%	10.3%	10.7%

RT43B	16a		12.05	5.4	160.8	77.6	80.3	82.1
(2)		±	0.40	1.4	18.5	6.7	7.0	7.4
RT5	17		21.55	4.7	252.0	82.0	82.6	83.1
(2)		±	0.98	2.0	38.2	9.7	9.8	9.9
RT42	17a2		24.68	8.0	262.6	88.2	89.8	90.9
(1)		±	4.25	2.3	64.8	26.0	26.7	27.4
RT45	17a2		23.83	8.5	266.6	72.0	76.2	79.4
(2)		±	0.71	2.5	73.0	13.1	14.6	15.9
RT39	17a2		26.01	8.6	267.1	84.7	90.0	94.1
(1)		±	1.08	2.9	74.0	21.5	24.2	26.5
RT40	17a2		13.78[4]	4.5	267.1	49.9	50.4	50.5
(1)		±	0.54	1.2	74.0	13.7	13.9	14.0
RT46	17a2		28.75	4.5	267.1	104.3	105.6	106.6
(2)		±	2.17	1.2	74.0	21.4	21.9	22.3
QT2	17a2		49.20	56.5	361.8	114.5	119.8	123.6
(2)		±	2.44	6.5	30.7	9.2	9.8	10.3
Mean Layer	17a2					101.9	106.5	109.8
(8)		±				6.5	6.9	7.2
						6.3%	6.5%	6.6%
QT5	20		29.08	6.2	259.2	108.6	110.9	112.3
(2)		±	0.99	1.8	49.3	14.8	15.3	15.8
QT74	23		44.27	104.6	271.5	114.1	116.1	117.6
(2)		±	1.49	15.5	37.3	11.7	12.1	12.4

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[1] Abbreviations:
EU = assuming early U uptake, $p = -1$
LU = assuming linear (continuous) U uptake, $p = 0$
RU = assuming recent U uptake, $p = 10$

Calculated using
α efficiency factor, κ_α = 0.15 ± 0.02
initial U activity ratio, $(^{234}U/^{238}U)_0$ = 1.20 ± 0.20
enamel water concentration, W_{en} = 2. ± 2. wt%
dentine water concentration, W_{den} = 5. ± 2. wt%
cementum water concentration, W_{cem} = 5. ± 2. wt%
enamel density, ρ_{en} = 2.95 ± 0.02 g/cm^3
dentine density, ρ_{den} = 2.85 ± 0.02 g/cm^3
cementum density, ρ_{cem} = 2.75 ± 0.02 g/cm^3

[2] Volumetrically averaged external dose rates using assumptions listed in Table 3.

[3] Calculated assuming the U uptake parameter, p = 10

[4] Not included in mean: Proximity to a large block of *éboulis* may have reduced $\mathcal{A}_\Sigma$.

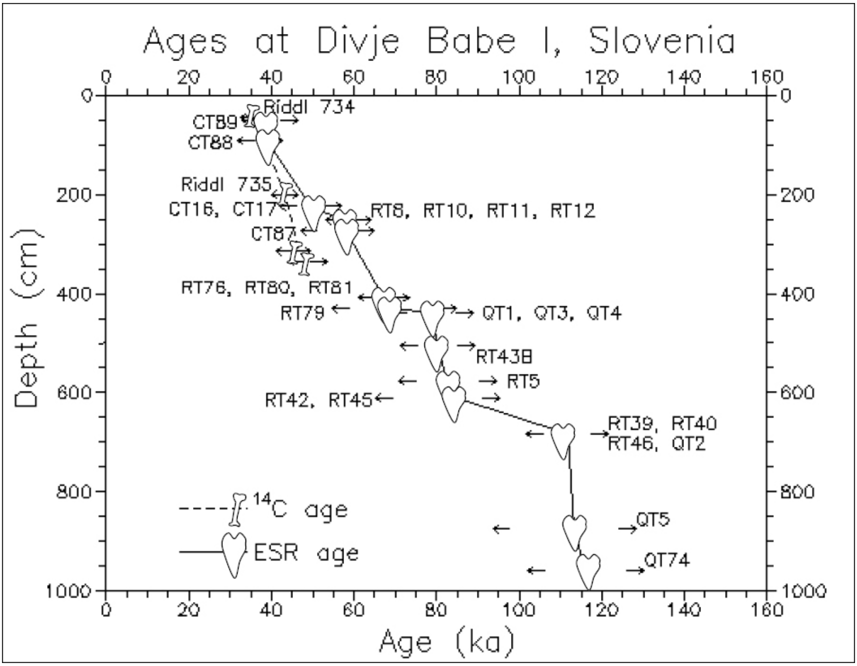

Figure 11.11. ESR dates at Divje Babe I, Slovenia. From the 26 teeth dated here by ESR, the ages are internally extremely consistent, despite the somewhat larger than normal uncertainties (denoted by the span between the arrows). The four bones successfully dated by ^{14}C hint that ^{14}C ages in the range from 40–50 ka may require a calibration of +2 to +5 ky to bring them into line with calendric ages, like ESR. The ESR dates show the cave filled with sediment episodically. A major depositional slowdown or hiatus occurred within Layer 17a2 between about 6.15 and 6.7 m below datum from approximately 105 to 85 ka. Another slowdown or hiatus occurred between Layers 12 and 13 lasting from ~ 78 to 70 ka. Another slowdown occurs from ~ 55 to 50 ka. (Table 11.5 lists layers and age data for the teeth plotted here.)

Sedimentological Analyses

These four sedimentation cycles based upon the dates match almost perfectly with the major climatostratigraphic phases and sedimentological facies determined by the sedimentological analyses. Although many sedimentological analyses were performed during, and after, the excavations, only morphogenic analyses provided conclusive data for climatostratigraphic interpretations of the cave sediment.

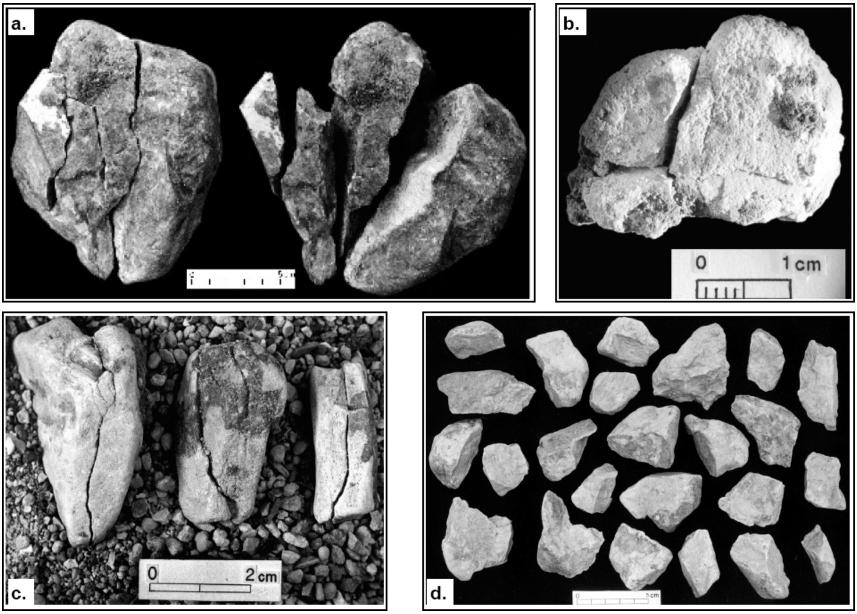

Figure 11.12. Congelifraction features from Divje Babe I, Slovenia. Clast breakage occurs when cold temperatures and moisture together cause the frost wedging and/or cryoturbation in the sediment: a–c. Congelifracts showing multiple breaks. d. Congelifracts created by the most recent cold event. Their presence suggests that cold temperatures affected the sedimentary layer sometime after its deposition (adapted from Turk et al. 2001b).

The sediment from Layers 2 to 23 was analyzed morphometrically and for diagenetic features that might indicate paleoclimatic events affecting the cave (Turk and Dirjec 1997). From the chronostratigraphic (Table 11.5; Figure 11.11) and sedimentological data (Table 11.1; Figures 11.12–11.16), the sedimentary deposition rate in Divje Babe is far from uniform as noted above, and the sequence contains at least one major hiatus in deposition, and another 2–3 depositional slowdowns or halts.

The sediment was analyzed for grain size, mineralogy, and diagenetic alteration, including cryoturbation, post-depositional cataclasis, especially congelifraction, post-depositional corrosion on clasts and the cave walls, and secondary cementation, especially authigenic aggregate formation (Turk and Dirjec 1997, Figure 3.6; Figure 11.14). In theory, congelifraction (frost-weathering) features (Figure 11.12) indicate the maximum severity of winter temperatures, while corrosion (Figure 11.13) on clasts, bones, and the cave walls, combined with secondary cementation and especially aggregate formation (Figure 11.14), denote the relative humidity in the sediment during deposition. Excessive amounts of condensation corrosion also provide a reliable indicator for a sedimentary depositional hiatus.

Paleotemperatures were estimated using the abundance of specific frost-shattered clasts (congelifracts) in each layer (Figures 11.12a–d). Semi-rounded to rounded clasts with at least one freshly broken surface having sharp edges were identified as post-depositional congelifracts resulting from the most recent paleoclimatic event. These contrast with other clasts having weathered faces joined by subrounded to well rounded corners, which indicate long periods of subsurface weathering due to normal karstic dissolution. Subsurface cementation can also occur initially to weld silt and sand into small aggregate particles. These processes, including cavernous corrosion on the larger clasts, occur on the cave ceiling, floor, and in the cave sediment, but once the clasts are buried below the typical freezing depth for the sediment, which may be reduced within caves compared to that outside, cryoclasis and corrosion cease, whereas cementation to form larger aggregates, encrustation on clasts, crusts, or brecciated zones continues. The relative timing for such events can be determined from the relative weathering rates on the various faces of clasts, making it possible to recognize several generations of weathering and cryoclasis, starting with completely angular clasts. The level of diagenetic alteration depends strongly on the sedimentation rate and the climate outside the cave, which controls that inside the cave.

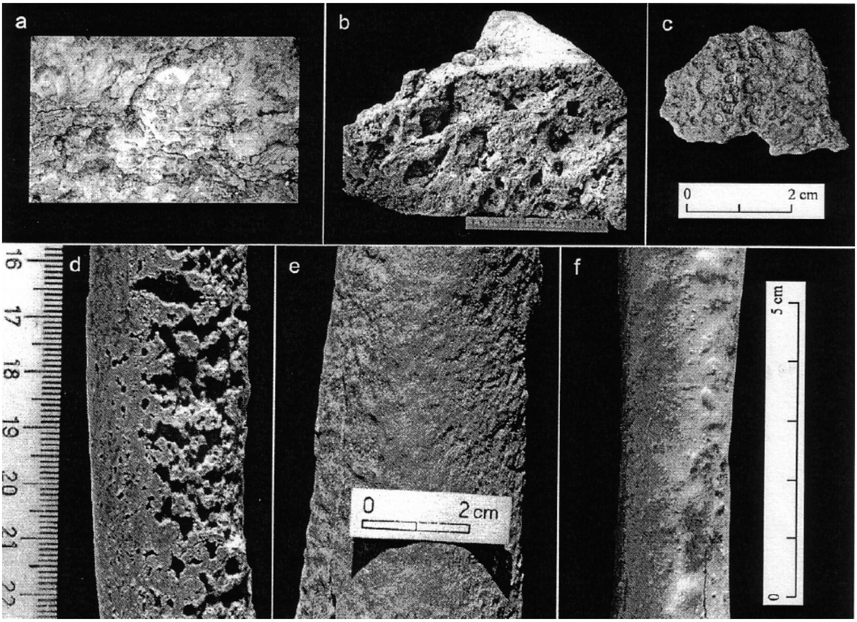

Figure 11.13. Cavernous corrosion features from Divje Babe I, Slovenia. Corrosion occurs when relatively cold water with low carbonate concentrations contacts carbonate clasts, bones, or cave walls: a. Corrosion on the current cave ceiling. b–c. Cavernously corroded clasts, corrosion that occurred on the clasts when they were on the cave ceiling, during the Pleistocene. d. A cavernously corroded bone, deposited under warm humid conditions. e–f. Bones etched by corrosion after their burial in the sediment, suggesting humid conditions after their deposition. Cavernous corrosion indicates relatively cool, humid climates within the cave. Cavernously corroded clasts or bones in the sediment suggest that climates were humid during, and immediately after, sedimentation. Corrosion can occur within the sediment, which must happen sometime post-depositionally (after Turk et al. 2002).

Sedimentological Analyses and Paleoclimatic Interpretations

At Divje Babe, cracked clasts with conjoining fragments, including those showing multiple generations of cryoclasis, are common and provide the best evidence for *in situ* congelifraction (Figure 11.12), suggesting the paleotemperature interpretations in Figures 11.15a and 11.16a. Faunal, palynological, and floral macrofossil (charcoal) data support these interpretations. This paleotemperature curve also compared well with global paleoclimatic curves determined from deep ocean $\delta^{18}O$ and terrestrial palynological records (Figure 11.16b). While no *a priori* reason exists why the paleotemperature curve at site some 100 to 200 km from the Adriatic Sea should respond immediately to global oceanic temperature changes, the agreement suggests that the response time to such changes at Divje Babe is less than the uncertainty associated with the ESR ages. Good correlations between the Divje Babe record and that for other terrestrial records, such as the Grand Pile, Les Echets, and Lago Grande di Monticchio pollen records, should be less surprising, since their response times should be on the same order of magnitude as any terrestrial paleoclimate record.

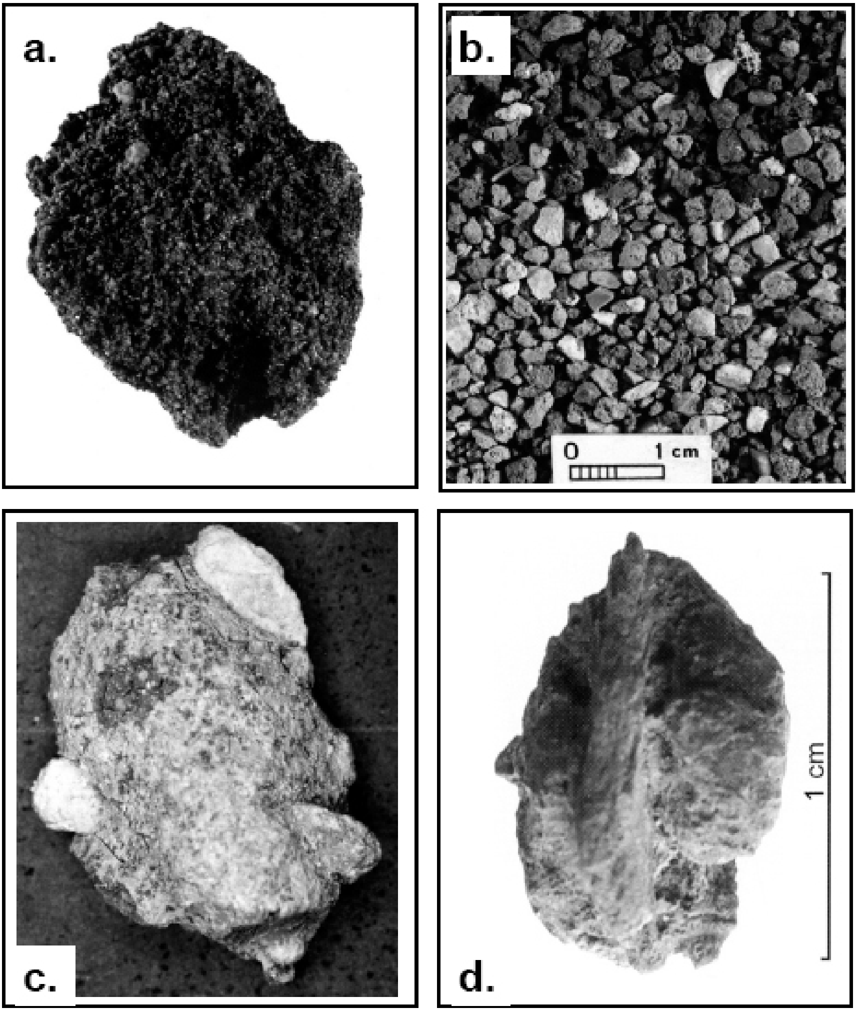

Figure 11.14. Aggregates from Divje Babe I, Slovenia. Aggregates form when dolomitic cement binds particles together: a. An aggregate with sediment grains cemented together. b. A sampling of the aggregates in one layer. c. An aggregate with bones and sediment grains. d. An aggregate of sediment particles around a bone splinter. High rates of aggregate formation suggest more humid climates, while low frequencies suggest drier climates.

Analyzing other properties that indicate paleohumidity, such as aggregate formation (Figure 11.14) and corrosion features (Figure 11.13), yielded a paleohumidity curve (Figure 11.15b). In a cave, condensation moisture generally increases under two sets of climatic conditions:

1. When regional temperatures rise and meteoric precipitation increases, the external environment has higher potential evapotranspiration, due to increased vegetational cover outside the cave, but also tends to have higher subsurface

watertables, increased regional karstic erosion, and cave formation, including bio- and geochemical erosion throughout the cave system. Within caves, this is expressed through increased production of dripstones, stalagmitic floors, and secondary sedimentary cementation from the groundwater, which is more highly saturated in dissolved carbonate. Alternating wet and dry seasons can initiate cementation, which does not strictly depend simply on temperature or humidity (see Tricart and Cailleux 1965). Sometimes, a short time lag occurs between the inception of condensation corrosion and the secondary sedimentary cementation.

2. When regional temperature drops with no change in meteoric precipitation, the potential evapotranspiration drops, but the relative atmospheric humidity rises both externally and within the cave. This is reflected by an increase in condensation corrosion on the cave walls, especially near the cave mouth. With lowered evapotranspiration and higher relative humidity, flowstone precipitation rates slow or stop in the cave, but surface weathering will likely increase, because colder water can dissolve more carbonate than warmer water.

By looking at all these factors in concert, one can assess the relative paleohumidity and paleotemperature from the sedimentary diagenetic features. In Divje Babe I, corrosion etching (Figure 11.13), aggregate formation (Figure 11.14), subsurface weathering rates, and frost wedging were used to build the paleoclimatic curves (Figures 11.15, 11.16a).

To verify the reliability of the Divje Babe I paleotemperature curves and assess the statistical uncertainty, samples from several profiles were compared wherever possible (see for example, Turk 2003a; Turk *et al.* 2001b, 2002) to derive composite paleotemperature and paleohumidity curves. Where the data were available, the values for the various parameters were standardized by comparing the raw data with a modern standard (interglacial) value to create a δ factor, which was then plotted versus time to produce the final composite climate curve seen in Figure 11.16a.

From the chronology and the paleotemperature curves, the following correlations are assumed as the basis for further comparisons:

1. Divje Babe Layer 13 was dated by ESR at 79 ± 8 ka (Table 11.5; Figure 11.11). At the hiatus between Layers 12 and 13, the whole sedimentary character changes, including the frequency of aggregates, corrosion, post-depositional cryoclasis of clasts in all classes (e.g., Figure 11.15). Preliminary pollen analyses also showed a shift at this point in pollen production, typical of the change from the late OIS 5a to OIS 4 (Šercelj and Culiberg 1991). Therefore, the top of Layer 13 was correlated with the OIS 5a-4 boundary at approximately 74–76 ka (Figure 11.16b). Because the changes in vegetation and sedimentation at higher altitudes may reflect earlier onset of colder conditions, however, this climatic change could have occurred as early as 78–80 ka at Divje Babe I.
2. Divje Babe Layer 6 was dated by ^{14}C at 43.3 ± 1.4 ky BP, while Layer 7 dated at 49.6 ± 5.5 ka by ESR (Figure 11.11). Given the ^{14}C calibration offset, Layers 6–7 probably date to about 46–50 ka. Interpreted as having a cold, dry climate (Climatic phase DB4 on Figure 11.16a), Layer 6 is assumed to correlate with the cold period between the Hengelo and Glinde Interstadials at approximately 44–46 ka (Figure 11.16b). This also corresponds chronologically with the lowest winter temperatures as inferred from the Grand Pile, Les Echets, and Lago

Grande di Monticchio pollen records (Allen *et al.* 1999, Figure 3f; Guiot 1990, Figure 12). Layer 7 (DB5), in contrast, is characterized by warm, humid conditions.

3. From the ESR dates, Divje Babe Layers 8c-7 were deposited between 52–55 ± 5.5 ka and 49.6 ± 5.5 ka (Figure 11.11). These beds were deposited during a cold, humid phase (DB6 on Figure 11.16a) that warmed up, but remained humid afterward (DB5). In Layer 7, the warmer Phase DB5 probably correlates directly with the longest warm period in OIS 3, which also corresponds to Zone 11 in the Lago Grande di Monticchio pollen record (Allen *et al.* 2000) and DO Event 14–16, the Moerschoofd-Glinde-Ørel Interstadials (Figure 11.16b). Given the preponderance of Levallois technique used to make the artefacts in Layers 7 and 8a, they appear to have strong affinities with the Mousterian. Since no non-Neanderthal skeletal evidence occurs in Europe at this time, it suggests that Neanderthals most likely made these tools and the associated flute.

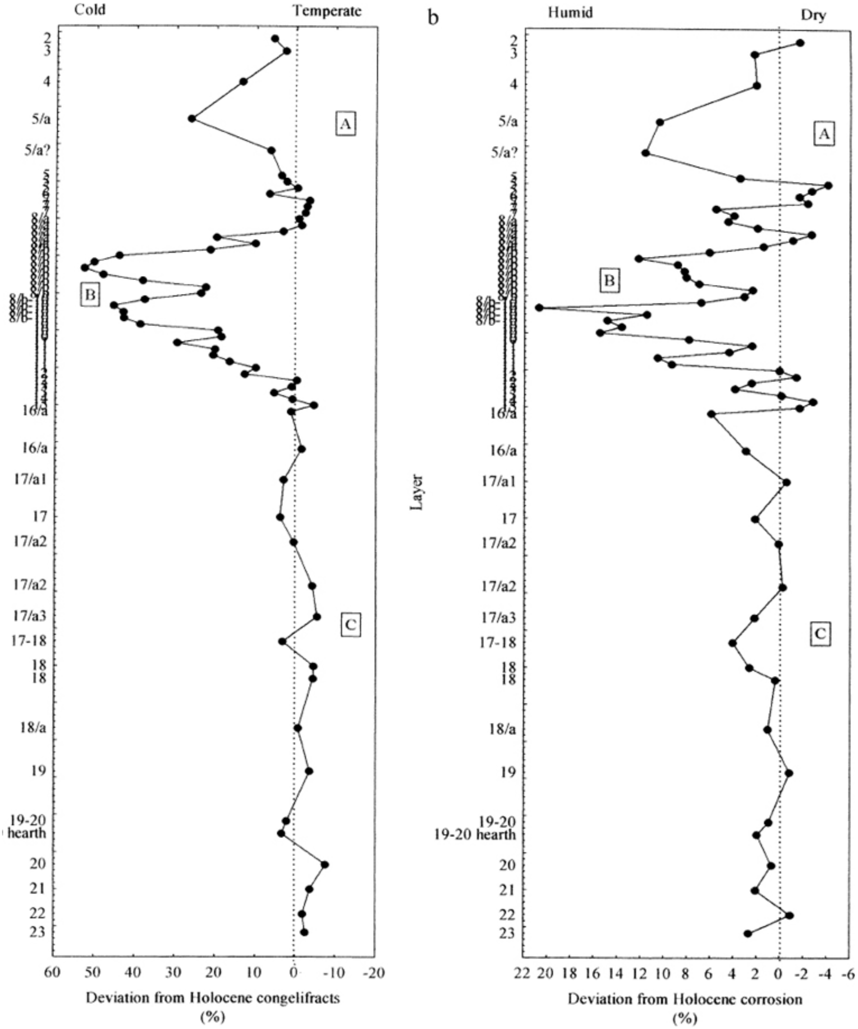

Figure 11.15. Distribution of paleoclimatic sedimentary features at Divje Babe I, Slovenia. The frequency of all the paleoclimatic sedimentary features, including congelifracts, etched clasts, and aggregates all vary dramatically with depth in the cave: a. Congelifracts between 10 and 40 mm in size: High percentages of broken clasts suggest cold climates, while low percentages suggest warmer climates. b. Etched clasts > 40 mm in size: High percentages of etched clasts suggest high soil moisture concentrations, and hence, more humid climates, while low percentages suggest drier climates. Closed symbols indicate dated layers (adapted from Turk et al. 2005).

This profile from Divje Babe I is the first sedimentological profile from a Slovenian cave to permit such correlations on a regional or continental scale. Correlations with other Mousterian and Aurignacian sites within the region are currently impossible due to the totally different methodology used to construct the chronologies for the other sites (*cf.* Osole 1990, 1991; Pacher *et al.* 2004; Turk

2006). Nonetheless, given the correlations above, other layers in Divje Babe I can be linked with specific regional and global paleoclimatic events:

4. Divje Babe Layer 2, containing Aurignacian deposits, dated to 35.3 ± 0.7 ky BP by ^{14}C (Nelson 1997), and by ESR at 39.7 ± 4.7 ka, while Layer 3 dated by ESR at 37.3 ± 3.5 ka. Given that an offset of $>$ 2 ky probably exists between ^{14}C ages in this range (van Andel *et al.* 2003), this suggests that Layers 2 and 3 were deposited in a warm, dry phase (DB1 on Figure 11.16a) at 38–39 ka, and most likely correlate with DO Event 8 (Figure 11.16b). From the pollen, this event is probably linked with the Les Cottés Interstadial (Bastin *et al.* 1976; Weissmüller 1997) on the GISP2–δ^{18}O curve.
5. Interpreted as a cold, moderately humid period, Divje Babe Layers 4–5a (DB2 on Figure 11.16a), probably correspond chronostratigraphically to the cold, humid phase between the Hengelo and Les Cottés Interstadials (Figure 11.16b; Dansgaard *et al.* 1993; Weissmüller 1997).
6. Since Divje Babe Layers 5a1–5 appear to have been deposited under warmer and somewhat drier conditions (DB3 on Figure 11.16a), they probably correspond chronostratigraphically to DO Event 12 at about 42–44 ka, which is equated with the Hengelo Interstadial (Figure 11.16b; Dansgaard *et al.* 1993; Weissmüller 1997).
7. In central and western Europe, the Middle-Upper Palaeolithic transition occurred during the Hengelo to Les Cottés Interstadial (i.e., ~ 44–34 ka). Divje Babe Layers 5–2 (DB3–DB1 on Figure 11.16a) correspond to this period archaeologically, chronologically, and paleoclimatically. At Divje Babe I, nothing special in the archaeological sense can be detected in this interval due to its sparse finds. By Layer 4, however, the occupants had abandoned the Levallois tradition, which, among other things, characterized the earlier Mousterian horizons (Blaser 1999, unpublished). Assuming uniform sedimentation rates, the MP-UP transition occurred about 40 ka.
8. The upper part of Divje Babe Layer 8b was deposited during a warm, humid climatic phase (Phase DB7 on Figure 11.16a), suggesting that it correlates chronostratigraphically with DO Event 18 at about 60 ka (Figure 11.16b).
9. The cold, very humid climatic phase (DB8 on Figure 11.16a) at the boundary between Layers 8b and 10 probably correlates with the cold phase from 62–65 ka in OIS 4, between DO Events 18 and 19 (Figure 11.16b).
10. Layer 10 dated to 67.1 ± 4.2 ka, while Layer 10–12 dated at 69.8 ± 13.0 ka by ESR (Figure 11.11; Table 11.5). Consequently, the cool, humid climatic phase in upper Layer 11 (Phase DB9 on Figure 11.16a) could correlate with DO Event 19 at about 68 ka (Figure 11.16b), while the slightly warmer, but still relatively humid phase in Layer 12 probably correlates with DO Event 20.
11. In the Divje Babe I sedimentary profile, the deposition of Layers 13 precedes a hiatus that correlates with the OIS 4/5a boundary and the early glacial maximum (= Würm 1/Early Weischelsian/Early Wisconsinan Glaciation) at about 78 ka. During glacial advances, sedimentation in any alpine location would be expected to stop or slow significantly (Campy and Chaline 1993; Bintz *et al.* 1997). Layers 13–14, which were deposited during a warm, relatively dry climatic phase (Phase DB10 on Figure 11.16a), correlate with DO Event 21 (= Odderade Interstadial), and OIS 5a (Figure 11.16b).
12. Layers 13–10 contain the richest Paleolithic horizon E, which included

"advanced" elements, such as becs and bone points (Figures 11.4 and 11.8), that might be used to characterize them as Upper Paleolithic (see Brodar 1999). Nonetheless, other technological features, such as extensive use of Levallois technique and the abundance of scrapers and denticulates, clearly indicate that this is a Mousterian assemblage. The dates indicate that these layers range from approximately 78 to 67 ka in age, during a time when the climate was cooling and becoming more humid (DB10–9 on Figure 11.16a).

13 The flowstone at the Layer 17–18 boundary (Phase DB15 on Figure 11.16a) had to have been deposited in a warm, moderately humid climatic phase. In lower Layer 17a2 (warm, dry phase DB14), just above the 17/18 boundary, ESR dates averaged 112 ± 13.0 ka, while below, Layer 20 (warm, moderately humid phase DB20) had an ESR age of 110.2 ± 15.3 ka, and Layer 23 (warm, dry phase DB21) dated at 116.1 ± 12.1 ka. Therefore, the Layer 17–18 boundary and the layers from lower 17a2 to 23 probably correlate best with the climatic optimum in OIS 5d at about 113–117 ka, DO Event 25. The cementation events that cement the "breccias" in Layers 15/16a (DB11), 18a (DB17), 20/21 (DB19), and 23 (DB21) appear to correlate with marginally cooler, but more humid periods during OIS 5, and appear to correlate with somewhat cooler phases on the GRIP curve (Figure 11.16b). These, however, may not be directly caused by these climatic shifts.

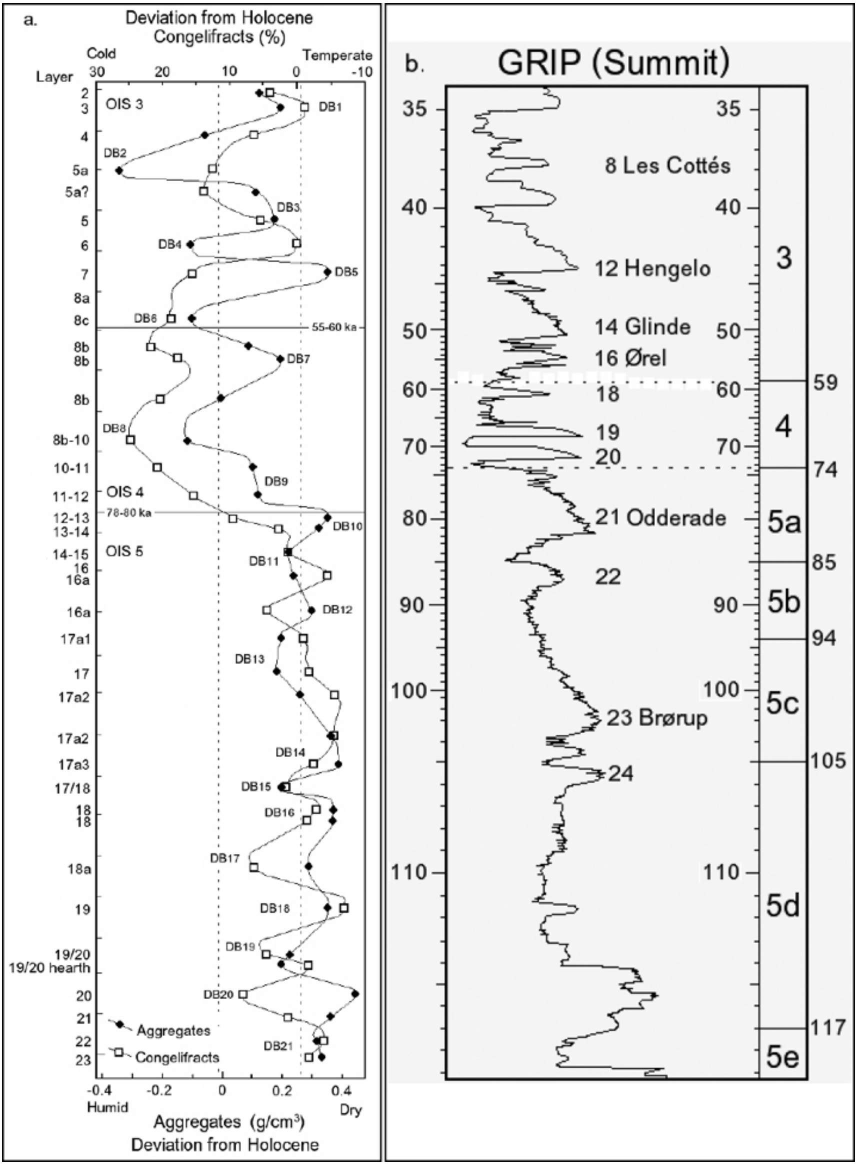

Figure 11.16. The Late Pleistocene paleoclimatic record at Divje Babe I, Slovenia. The Late Pleistocene shows major climatic fluctuations which correlate well with the climatic record in other Late Pleistocene records: a. By comparing the Holocene frequency of aggregate and congelifract formation in the cave against that seen in Pleistocene sediment, relative temperatures and humidity profiles can be constructed. The vertical dotted lines represent the means for the glacial and interglacial periods, while the solid line shows the deviation within the sedimentary layers. b. The GRIP (summit) record for Pleistocene climate (adapted from Weismüller 1997). This strong correlation in OIS 3 and 4 suggests relatively continuous sedimentation. At the boundary between Layers 12 and 13 dated at ~ 80 ka, a short depositional hiatus occurred. A short hiatus or

depositional slowdown may have also occurred between Layers 6 and 7, and possibly with Layer 17a2.

Conclusions

The ESR analyses used here represent one of the most detailed ESR studies ever reported. Because the teeth were excavated with the precise intension of doing ESR dating, detailed sediment sampling accompanied each sample to ensure an accurate age profile, despite the variability in the external dose rates for various layers. Extensive use of volumetrically averaged sediment dose rates provided a more detailed external dose rate profile for this site than is usually possible with other dosimetric methods. Moreover, this is currently the only site in which ESR dating has been combined with detailed sedimentological analyses to enable paleoclimatic reconstructions at this level of detail. While the organic preservation at Divje Babe I is remarkable, such analyses could be performed at any archaeological site where sufficient numbers of teeth and sediment samples can be obtained. Given the relative cost between a single ESR date and those for ^{14}C or ^{230}Th/^{234}U, it is possible to complete more ESR dates for the same cost.

Altogether, 42 subsamples were dated from 26 *Ursus spelaeus* (cave bear) teeth found in Layers 2 through 23 to build a detailed and precise chronostratigraphic sequence (Table 11.5; Figure 11.11) which allowed other sedimentological analyses to be tied to an absolute time sequence (*e.g.*, Figures 11.15, 11.16; Turk *et al.* 2001b). The resulting paleoclimatic interpretations could then be correlated with other regional and global climatic events.

The chronology of Divje Babe I as currently understood assumes that the ^{14}C dates are reliable for Layer 2 to Layer 6, but may require a $+2$ to $+5$ ky shift for calibration, and that the ESR dates are reliable, within their uncertainties, for Layers 2 to 23. The chronometric dates suggest that Layers 2 to 23 record two to four sedimentation pulses, but several more climatic cycles.

Sedimentation in Layer 23 to the lower part of 17a2 began at about 116 ka and continued until approximately 102 ka under warm climates, that alternated from dry to moderately humid conditions, during OIS 5d at a sedimentation rate of 0.02 cm/y. Then, sedimentation slowed drastically or stopped until about 85 ka, during OIS 5c and 5b. From approximately 85 ka until 80 ka during OIS 5a, Dansgaard-Oeschger Event 21, sedimentation resumed, depositing upper Layer 17a2 through Layer 13 under warm, but dry to moderately dry conditions at a sedimentation rate averaging 0.036 cm/y. Sedimentation again slowed or stopped until about 70 ka during the first cold phase in OIS 4.

At this point, the character of the sedimentation changed dramatically, reflecting processes more prevalent under glacial, rather than interglacial, conditions. From about 70 to 55 ka in late OIS 4 to early OIS 3, rapid deposition at ~ 0.012 cm/y resumed, producing Layers 12 through 8c, under more variable temperatures, but humid conditions. During this period, sedimentation events that reflect changing climatic conditions and that appear to correlate with cold and warm, but humid phases, seen in other European and global climatic phases can be recognized, including DO Events 20 to 18. Then, the sedimentation slows again from 55 to 50 ka, but does not appear to stop totally, because Layer 7 to 8a show a warm climatic signature that appears to correlate with other global records, including the longest warm period in OIS 3, DO Events 14–16, and the Moerschoofd-Glinde-Ørel

Interstadials. From about 45 to 38 ka, sedimentation sped up, depositing Layers 6 to 2, at a mean rate near 0.04 cm/y. Climatic oscillations recorded in these beds appear to correlate well with fluctuating climates from DO Events 12 through 8 during OIS 3. The cave sediment does preserve a record of the effects from OIS 2 in the form of pervasive post-depositional cryoturbation in Layers 5a-2, but little sediment actually deposited during OIS 2 has survived within the cave, except as small isolated pockets trapped within the almost sterile cryoclastically affected sediment from earlier layers.

From approximately 110 ka until 40 ka, Mousterian people visited the cave sporadically leaving behind their hearths, flint and bone artefacts. Judging by the frequency of hearths, cave occupation or utilization was more intense in OIS 3 and 4, than in OIS 5. Based on computerized tomography and experimental archaeological studies on the Mousterian tools in the cave and the perforated cave bear femur, humans did bore the holes in the femur before abandonning it to a carnivore who gnawed the ends off the flute at about 60 ka. Chronologically, the Middle/Upper Paleolithic transition occurs at the cave at the end of Layer 4's deposition or immediately above this layer during mid OIS 3, at about 40 ka, assuming uniform sedimentation rates for Layers 6–2. Aurignacian peoples then used the cave for a short time from 40 to 38 ka, after which no Paleolithic deposits occur.

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12. Early Upper Paleolithic Population Dynamics and Raw Material Procurement Patterns in Italy

Julien Riel-Salvatore and Fabio Negrino

Abstract

Contemporary discussions of the Middle-Upper Paleolithic transition need to employ common analytical yardsticks in order to objectively compare the two periods. We present new perspectives on that issue in the Italian peninsula, focusing on raw material procurement dynamics as the analytical constant to compare late Mousterian, Uluzzian, and Aurignacian assemblages. Evidence from the northern and the southern parts of the peninsula combine to suggest that some of the distinctions between the Uluzzian and Aurignacian patterns may reflect fundamentally different ways in which the Early Upper Paleolithic landscape was conceptualized. Combined with new data about the age of the Aurignacian and Uluzzian in southern Italy, these observations suggest that increased raw material transfers do not represent a useful monitor of behavioral modernity, and that more attention needs to be given to the context of individual assemblages in order to reconstruct population dynamics across the Transition interval.

Introduction

This paper aims to be a comprehensive discussion of human population dynamics across the so-called Middle-Upper Paleolithic Transition in the Italian peninsula, a research theme prompted by two main factors. Firstly, Italy's geography has always positioned it as a bridge between the Balkans and the rest of western Europe. Secondly, the results of Italian prehistoric research are generally poorly disseminated beyond the bounds of the country. To remedy this situation, we present an up-to-date overview of current data to ensure that empirical and theoretical developments in Italy can be integrated in broader, pan-Mediterranean perspectives on the topic of modern human origins. We frame our study within a discussion of the purported social geographies of Mousterian, Uluzzian and Aurignacian groups as inferred from raw material transfer patterns, a long-standing component of the trait list of the archaeological monitors of "modern behavior". We begin by reviewing and discussing of recent data from the north of the peninsula – an area whose record is relatively well-known internationally – before incorporating complementary data from the center and south of the peninsula in order to generate a peninsular view of population dynamics during the Transition interval. Doing so allows us to assess the validity of traditional models of the nature of cultural dynamics at that time, as well as to clarify the nature of potential modern human-Neanderthal interactions. We conclude with a summary discussion of new chronological studies from southern Italy that may have important implications for our understanding of the timing of the emergence of modern human behavior in the peninsula.

The Middle-Upper Paleolithic Transition in Italy

The Italian peninsula is an appealing area in which to study the Middle-Upper Paleolithic Transition for ecological, geographical and anthropological reasons. First, its position as a peninsula aligned roughly north-south *in* the Mediterranean – and its correspondingly generally temperate climate relative to the rest of the European landmass – made it a natural refugium for both fauna and hominins during Quaternary glacial advances (Finlayson 2004, 16, 68; van Andel *et al.* 2003). Furthermore, while the northern two-thirds of the peninsula would have been connected to the Balkans by the low-lying deltaic plain of the northern Adriatic during long segments of the Late Pleistocene, southern Italy would have remained an isolated geographical *cul-de-sac* (Shackleton *et al.* 1984; van Andel *et al.* 2003). These two observations highlight the importance of Italy as a potentially very informative "archaeological laboratory" in which the human dynamics of the Transition would have been magnified by the combined impacts of higher population densities, a peninsular geography of limited area, and high ecological diversity.

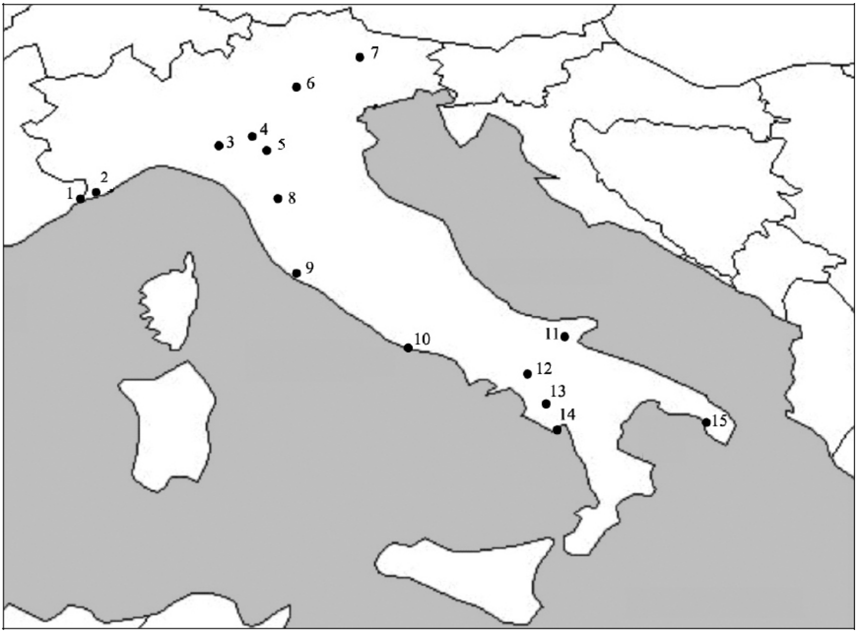


Figure 12.1. Map of Italy, with sites discussed in the text indicated by numbered dots. 1: Balzi Rossi: Riparo Mochi, Riparo Bombrini, ex-Birreria site; 2: Via San Francesco; 3: Ronco del Gatto; 4: Lemignano; 5: Ghiardo Cave; 6: Riparo di Fumane; 7: Monte Avena; 8: Pontecosi; 9: Grotta La Fabbrica; 10: Monte Circeo: Grotta Breuil, Grotta del Fossellone, Grotta Barbara; 11: Grotta

Paglicci; 12: Serino; 13: Grotta di Castelcivita; 14: Grotta della Cala; 15: Grotta del Cavallo, Grotta Mario Bernardini, Grotta di Uluzzo, Grotta-Riparo di Uluzzo C, Grotta della Serra Cicora A.

From an anthropological perspective, the analytical units (*i.e.* the "cultures") of the Transition in Italy are represented by regional Mousterian and Aurignacian facies, as well as a transitional industry – the Uluzzian (Kuhn and Bietti 2000; Mussi 2001; Palma di Cesnola 1993, 1996). Relevant chronological data are presented in Table 12.1. The Uluzzian is identified on the basis of small crescent-shaped microliths, a combination of many Middle and a few Upper Paleolithic tool types, and a high incidence of splintered pieces (Palma di Cesnola 1993). The industry is known from cave and rockshelter sites that usually contain several Uluzzian layers, reinforcing the view that it represents a distinct industry rather than a mixing of Mousterian and Aurignacian assemblages, with both of which it shares little technologically (Kuhn and Bietti 2000). Due to the fact that they lack secure stratigraphic and contextual integrity, a dozen open-air Uluzzian sites are excluded from most studies, including this one, resulting in a useable sample of eight stratified Uluzzian sites (see Figure 12.1).

At present, it is fair to say that the "transitional" record of northern Italy is better known overall than that of the south, thanks to a relative abundance of dated Late Mousterian and Aurignacian assemblages, some of which are further contextualized by paleoenvironmental data. In contrast, we lack a reliable chrono-climatic framework for the transition in the south of the peninsula, the area where the Uluzzian developed. The one exception to this rule is Grotta Castelcivita (Gambassini 1997a), where radiocarbon dates indicate a late emergence of both the Uluzzian and Aurignacian, in that order of appearance. It is important to stress that while currently available data are not *incompatible* with the idea that the Uluzzian emerged only after the appearance of the earliest Aurignacian in Italy as a result of some form of 'acculturation' of Neanderthals by anatomically modern humans (Kuhn and Bietti 2000, 70-71; Mussi 2001; Palma di Cesnola 2004), its chronostratigraphic position and the degree of behavioral modernity it embodies largely remain enigmas.

Raw Material Transfers

This paper focuses predominantly on raw material procurement patterns to address the question of human population dynamics in Early Upper Paleolithic Italy. This analytical focus is due to the repeated inclusion of this facet of the archaeological record into trait lists used by some researchers to define the "material signature" of behavioral modernity (*e.g.* Bar-Yosef 2002, 2003; Mellars 1996, 2005; but cf. Clark 2002; Henshilwood and Marean 2003). Specifically, these authors argue that exotic raw materials were transferred more frequently and over greater distances during the Aurignacian than during the preceding Mousterian, an element taken to directly reflect the extent of the geographical ranges of foragers groups and the extent of their social networks. Given that the same researchers attribute the Mousterian to Neanderthals and the Aurignacian to modern humans, it has been argued *post hoc* that this difference must somehow reflect the "modern" behavior of modern humans who are assumed to have extirpated the Neanderthals from Eurasia over the Transition interval. The pattern of raw material transfers for "transitional" industries such as the Uluzzian is generally left unaddressed in most discussions, though based on the latter's putative attribution to Neanderthals (Churchill and Smith 2000; Kuhn and Bietti 2000; Palma di Cesnola 2004), it is not unreasonable to assume that they should resemble Mousterian ones.

From this perspective, increased and more far-ranging raw material transfers are interpreted as symptomatic of the "appearance of extensive and organized exchange systems for the distribution of both raw material and decorative prestige items" (Mellars 2005, 16) qualitatively different from anything in the preceding Mousterian. In a recent review of ethnographic data on hunter-gatherer geographical ranges, however, Marwick (2003) argues that lithotype transfers surpassing 140 km indicate the existence of exchange networks that can only exist with fully modern linguistic capacities and, by extension, fully modern behavior. This is an interesting observation in light of the fact that raw material procurement patterns of the Central European Mousterian greatly surpass that supposed threshold (Féblot-Augustins 1997), perhaps leading to the conclusion that Neanderthals must have possessed modern behavior. That most interpretations reject this conclusion emphasizes the kind of double-standard that pervades many comparisons of the Middle and Early Upper Paleolithic archaeological records and highlights the prevalence of *post hoc* accommodation implicit in much contemporary research that seeks to differentiate "archaic" and "modern" humans (Roebroeks and Corbey 2000). In the case of raw material transfers, for Neanderthals such a pattern is usually explained as an atypical and presumably short-lived behavioral mode that does not characterize the species/population as a whole. For the modern human makers of the Aurignacian, on the other hand, it is generally taken for granted that this behavior is a generalized one that defines the makers of this industry. In contrast with the situation for the Mousterian, when the absence of this pattern is noted in an Aurignacian assemblage it is typically explained as the result of adaptation to especially favorable local conditions or an assemblage's function-specific nature.

Despite the inbuilt assumptions of these views, which were developed based on the archaeological records of southwestern France (Mellars 1996, 2005) and the Levant (Bar-Yosef 2002, 2003), they have the merit of being amenable to testing using data from other regions. The present study is thus an empirical test of the validity of facet of this model concerned with lithic raw material using the archaeological record from a well-bounded and geographically meaningful analytical unit, namely the Italian peninsula. This research fits within a broader set of studies that have begun to critically examine the empirical foundation of accepted wisdoms about what constitutes "modern" behavior, especially identified through the use of "trait lists" (*e.g.* Henshilwood and Marean 2003; see also Grayson and Delpech 2002). Of specific interest here, a number of recent studies that fit within this larger effort have sought to address the meaning of differences in lithotype transfer patterns in the archaeological record from a variety of perspectives (*e.g.* Brantingham 2003; Marwick 2003).

Nonetheless, the use of changes in raw material procurement patterns as an alleged diagnostic feature of modern behavior continues unabated in recent synthetic overviews of the Transition (*e.g.* Mellars 2005). This, along with the critiques mentioned above, fully justifies taking a critical look at the Italian data in an attempt to test the empirical "goodness of fit" between the expectations of the trait list model as concerns raw material exploitation and what the record actually demonstrates. To do so, a focus on lithitype transfer patterns is especially useful since it offers a common yardstick according to which assemblages belonging to different typologically-defined industries can be objectively compared. As well, this facet of the archaeological record offers the potential of addressing issues of social organization during that crucial interval of our recent evolutionary past, thus allowing for discussions of human population dynamics during that period.

Table 12.1. Chronometric dates for the Italian Late Middle Paleolithic and Early Upper Paleolithic. Sources: 1. Cremaschi et al. 2005; 2. Martini et al. 2001; 3. Leonardi and Broglio 1966; 4. Schwarcz et al. 1990-1991; 5. Alhaique et al. 2000; 6: Pitti and Tozzi 1971; 7. Palma di Cesnola 2003a; 8. Gambassini 1997b; 9. Broglio 1994; 10. Accorsi et al. 1979; 11. Hedges et al. 1994; 12. Azzi et al. 1977; 13. Benini et al. 1997; 14: Alessio et al. 1970.

Site	*Archaeology*	*Level*	*Date*	*+/-*	*Method*	*Source*
Fumane	Proto-Aurignacian	D3b	31700	1200/1100	AMS 14C	1
	Proto-Aurignacian	D3b	32300	400	AMS 14C	
	Proto-Aurignacian	D3ba – str. 15 – liv. A	30320	320	AMS 14C	
	Proto-Aurignacian	D3ba – str. 15 – liv. A	32020	340	AMS 14C	
	Proto-Aurignacian	D6	32300	500	AMS 14C	
	Proto-Aurignacian	D6	37100	240	AMS 14C	
	Proto-Aurignacian	A1	31900	500	AMS 14C	
	Proto-Aurignacian	A2	32100	500	AMS 14C	
	Proto-Aurignacian	A2	30650	260	AMS 14C	
	Proto-Aurignacian	A2	31830	260	AMS 14C	
	Proto-Aurignacian	A2	36500	600	AMS 14C	
	Proto-Aurignacian	A2	33160	400	AMS 14C	
	Proto-Aurignacian	A2	32000	90	AMS 14C	
	Proto-Aurignacian	A2	32700	140	AMS 14C	
	Proto-Aurignacian	A2R	34312	347	AMS 14C	
	Proto-Aurignacian	A2 – str. 9	31600	400	AMS 14C	
	Proto-Aurignacian	A2 – str. 10	32800	400	AMS 14C	
	Proto-Aurignacian	A2 – str.10	40000	4000/3000	AMS 14C	
	Proto-Aurignacian	A2 – str. 16	31300	395	Conventional 14C	
	Proto-Aurignacian	A2 – str. 19	32415	1045	AMS 14C	
	Proto-Aurignacian	A2 – str. 19	33140	460	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – top	31900	1100	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – top	34120	460	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – liv. A	36800	1200/1400	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – liv. B1	35400	1100/1300	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – liv. B2	34200	900/1100	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – base	31620	500	AMS 14C	
	Proto-Aurignacian	A2 str. 14 – base	33640	440	AMS 14C	
	Mousterian	A4	33300	400	AMS 14C	
	Mousterian	A4II	33150	600	AMS 14C	
	Mousterian	A5	33700	600	AMS 14C	
	Mousterian	A6	34950	700	AMS 14C	
	Mousterian	A6	34400	800	AMS 14C	
	Mousterian	A6	> 29000		Conventional 14C	
	Mousterian	A6	> 35000		Conventional 14C	
	Mousterian	A6	50000	8000	TL	2
	Mousterian	A5+A6	38800	750	AMS 14C	1
	Mousterian	A5+A6	38250	700	AMS 14C	
	Mousterian	A9	39950	550	AMS 14C	
	Mousterian	A9	42751	720	AMS 14C	
	Mousterian	A9	> 31400		Conventional 14C	
	Mousterian	A10	41327	730	AMS 14C	
	Mousterian	A11	42004	760	AMS 14C	
Grotta del Broion	Mousterian	I	40000	1270	Conventional 14C	3
	Mousterian	I	46400	1500	Conventional 14C	3
Grotta Breuil	Mousterian	3 – 4	36600	2700	ESR (LU)	4
	Mousterian	6	33000	5000	ESR (LU)	5

Buca della Iena	Under Mousterian	Under Mousterian	41000		U/Th	6
Grotta all'Onda	Under Mousterian	Under Mousterian	39300	3200	U/Th	6
Grotta di Sant'Agostino	Mousterian		43000	9000	ESR (LU)	4
Grotta Paglicci	Proto-Aurignacian	24Ai	29300	600	?AMS 14C	7
	Proto-Aurignacian	24Bi	34000	900/800	?AMS 14C	
Grotta Castelcivita	Proto-Aurignacian	6	32390	490	AMS 14C	8
	Proto-Aurignacian	8	31950	650	Conventional 14C	
	Proto-Aurignacian	9	32930	720	Conventional 14C	
	Uluzzian	10 – 11	32470	650	Conventional 14C	
	Uluzzian	12	> 34000		Conventional 14C	
	Uluzzian	12	33300	430	Conventional 14C	
	Uluzzian	14	33220	780	Conventional 14C	
	Mousterian	27–28	33800	1300	Conventional 14C	
	Mousterian	29–30	39100	1300	Conventional 14C	
	Mousterian	29–30	42700	900	Conventional 14C	
Grotta di Paina	Proto-Aurignacian	9	37900	800	?AMS 14C	9
	Proto-Aurignacian	9	38600	1400/1800	?AMS 14C	
Serino	Proto-Aurignacian	12	31200	650	Conventional 14C	10
Riparo Mochi	Proto-Aurignacian	G/50	32280	580	AMS 14C	11
	Proto-Aurignacian	G/51	33400	750	AMS 14C	
	Proto-Aurignacian	G/56–57	34680	760	AMS 14C	
	Proto-Aurignacian	G/59	35700	850	AMS 14C	
	Proto-Aurignacian	G/60	34870	800	AMS 14C	
	Proto-Aurignacian	G/base	37400	1300	?Conventional 14C	5
Grotta della Cala	Proto-Aurignacian	13	29850	870	Conventional 14C	12
	Proto-Aurignacian	13	27050	850	AMS 14C	13
	Uluzzian	14	29120	300	AMS 14C	
Grotta del Cavallo	Uluzzian	E II-I	>31000		Conventional 14C	14

Data Selection

We limit the analytical scope of this study to a restricted subset of assemblages, namely those that (1) were found stratified *in situ*, (2) contain over 40 lithics (of any type) and (3) were recovered and analyzed according to modern methods. As well, we exclude those assemblages that have been discussed in a preliminary fashion, as they generally do not allow us to assess the potential impact of collection methodologies and/or taphonomic factors on the integrity of the assemblages. While we present data from our own ongoing projects, we explicitly discuss their context and the recovery methods in order to ascertain that they are "up to snuff" for our analytical purposes.

We do not impose these strictures on our data selection protocol out of any desire to discriminate against or call into question the quality of the work of certain research teams. Rather, such criteria must be imposed in order to ensure the maximum comparability of data from various sites and to exclude assemblages that might lead to unwarranted characterizations of the Italian record as a whole. In fact, the results of the present study will yield reliable conclusions about population dynamics in the peninsula during the Transition interval, conclusions that can then be assessed using data from assemblages omitted from this study to test their empirical robustness.

Our analysis separates Italy into three segments (north, center and south) in an effort to isolate regional trends that can subsequently be integrated to derive a general understanding of the patterns of raw material transfers of the industries involved in the Transition in the peninsula. For each segment, we begin with an explanation of site selection and follow this with an analysis of the raw material procurement patterns identified in the various assemblages coming from a given site. These results are then contextualized with data from other reliable assemblages, leading to a synthetic overview of raw material transfer for each region across the Transition.

The Transitional Record in Northern Italy

The Transitional record of northern Italy is relatively abundant and the region has so far yielded only Mousterian and Aurignacian assemblages (Bietti 1997; Kuhn and Bietti 2000; Mussi 2001; Palma di Cesnola 1993, 1996). While d'Errico *et al.* (1998; see also Zilhão and d'Errico 1999) mention the presence of an Uluzzian assemblage in level A41 of Fumane, this interpretation is unwarranted since the assemblage bears little techno-typological similarities to other Uluzzian assemblages. In fact, it appears to be the result of mechanical mixing of Mousterian and Aurignacian artifacts from the levels that sandwich it (Broglio and Cremaschi 1999). Except for numerous surface assemblages (attributed to the Mousterian, Uluzzian [in Tuscany only], and Aurignacian), there appears to be little reason to omit many assemblages from our survey, save for the alleged Aurignacian assemblages from the Barma Grande and Balzo della Torre (part of the Grimaldi sites), since they were collected unsystematically in the latter part of the 19th century. Thankfully, recent excavations at two of the Balzi Rossi sites allow us to incorporate reliable data from this important site complex into our analysis. We begin our analysis with data collected by one of us (FN) from a series of assemblages from Liguria, Emilia-Romagna and northern Tuscany, in order to develop an empirical base on which to build a generalized model of raw material procurement patterns in the north of the peninsula (see Negrino 1998-2002 for full discussion).

The Balzi Rossi: Riparo Mochi and Riparo Bombrini

Riparo Mochi and Riparo Bombrini are part of the Grimaldi Caves – arguably one of the most important Pleistocene archaeological localities in Italy, if not Europe – and both sites have yielded Aurignacian and Mousterian assemblages excavated using rigorous and modern methods that include fine-sieve water-screening and tridimensional piece-plotting (Alhaique *et al.* 2000; Holt *et al.* 2003, 2006; Kuhn and Stiner 1998; Negrino *et al.* 2004). Since excavations at Bombrini are ongoing, we focus this discussion mainly on the material from Mochi, incorporating insights from the unpublished material from Bombrini when necessary to highlight specific features of the record. Overall, at Mochi, the Mousterian displays a diachronic shift from a Levallois-based core preparation strategy in its lower levels to one dominated by more generic discoid methods (Negrino 1998-2002). Throughout the Mousterian sequence, however, the stone procurement strategy is centered almost exclusively on the exploitation of local resources, namely flint of usually passable quality from the nearby "Ciotti" conglomerates (del Lucchese *et al.* 2000-2001). While this material dominates all Mousterian assemblage at Mochi, they also contain relatively frequent tools on quartzarenites from the Sanremese (dubbed "circumlocal," as this area is located 15-20 km away) as well as rare elements on French lithotypes such as rhyolite from Estérel and quartzite from Castellane.

Layer 44 at Mochi also yielded a denticulated scraper on yellowish-red flint likely derived from sources near Trevans in modern-day France (about 80 km away). The implements on circumlocal and exotic materials comprise mainly large Levallois points and retouched tools (Negrino 1998-2002, 50), suggesting that these materials were valued, likely due to their greater workability and durability compared to local flint. An almost exclusive reliance on locally available raw materials in the Mousterian is also documented in the Mousterian levels from Riparo Bombrini (see Vicino 1984), with one important exception represented by a pseudo-Levallois point made on jasper from eastern Liguria whose outcrop is roughly 150 km west of the site (Holt *et al.* 2003, 2006; Negrino and Starnini 2003). While keeping in mind that this is a single artifact, this discovery nonetheless considerably extends the geographical range of Mousterian procurement systems at the Balzi Rossi.

The situation changes dramatically in the earliest Aurignacian layer at Mochi (Layers G – see Kuhn and Stiner 1992, 1998). In addition to typological and technological shifts bespeaking the wholesale adoption of blade and especially bladelet production methods radically different from anything seen previously in the Mousterian, Table 12.2 indicates that raw material procurement patterns also underwent significant modifications. While Ciotti flint remains the dominant raw material, the exploited lithotypes include the first common instances of material from over 100 km away, such as flints from the Vaucluse, Ligurian-Emilian cherts and distinctive reddish and pinkish “Scaglia” flints likely from the Marche region in central Italy, over 400 km away! These new, clearly exotic materials are complemented by a broader range of circumlocal materials such as various grey-white vitreous flints (perhaps from the Liguro-Emilian arc) and chalcedony (perhaps from the Finalese) (Negrino 1998-2002, 74-75). In addition, the Early Upper Paleolithic exploitation of Ciotti flint at Mochi is much more selective than in the Middle Paleolithic. Whereas the Mousterian assemblages attest to a relatively uncritical and opportunistic selection of flint nodules, the material exploited by Aurignacian toolmakers underwent a more exacting selection process resulting in the predominant exploitation of the more fine-grained varieties of local material. Again, the early Aurignacian at Bombrini (Layer 3) generally conforms to the pattern seen at Mochi, though we hope to soon publish analyses of the lithotypes exploited at Bombrini to empirically assess the similarities between the two sites.

Table 12.2. Raw material frequencies for the Layer G proto-Aurignacian assemblage from Riparo Mochi. VF = very frequent, P = present, R = rare, N/A = not applicable, Overall = weighted average of blades, bladelets and retouched tools. Note that, except for N, all numerical values are percentages.

	Cores	*Unret. Flakes*	*All Blades*	*All Bladelets*	*Other Retouched*	*Overall*
Ciotti Flint	VF	VF	0.0	70.2	27.5	65.4
Quartzite/Quartzarenite	-	P	0.0	0.6	7.8	1.3
French Flint	R	P	50.0	18.8	47.1	21.8
Rhyolite	-	P	0.0	0.2	0.0	0.2
E-L Chert	R	P	50.0	4.1	5.9	4.8
"Scaglia" Flint	-	P	0.0	2.1	0.0	1.8
Other	-	P	0.0	3.9	11.8	4.6
N	N/A	N/A	6	484	51	541

Ronco del Gatto

Further east, the open-air site of Ronco del Gatto also contains Mousterian and Aurignacian deposits and thus provides an interesting comparative sample to the Balzi Rossi sites (see Figure 12.2). The site is located next to outcrops of high-quality radiolarite and appears to have been used through all the Late Pleistocene principally as an extraction site where blanks and cores were prepared prior to being taken elsewhere by mobile foragers. In the Mousterian, Levallois methods were preferentially used to produce flakes, and all of the available varieties of locally available stone were utilized, regardless of flaking properties. For instance, Mousterian toolmakers indiscriminately selected nodules of fine-grained maroonish vitreous rock and nodules of coarser-grained greenish material replete with inclusions that diminished its workability. The only exotic lithotype in the Ronco del Gatto Mousterian is a kind of gray quatrzarenite, largely utilized in the near by open-air Mousterian site of Ghiardo Cave, although it is represented by only a few, mainly retouched, implements (Negrino 1998-2002, 23-34).

The Aurignacian of Ronco del Gatto displays a much higher density of chipped stone than the Mousterian, although its raw material exploitation pattern also is dominated by local raw materials, including also a grey-white flint that outcrops a few dozen meters from the site. Interestingly, and in contrast to the situation at the Balzi Rossi, exotic stone is very rare in the Ronco del Gatto Aurignacian, albeit being somewhat more diverse than in the Mousterian. In contrast to the Mousterian, however, the more homogeneous and vitreous varieties of local material were preferentially selected and there is very little evidence of the use of poorer quality local material (Negrino, personal observation). Exotic materials include several varieties of Apenninic stones such as lutite and quartzarenites procured from 50-60 km away. This pattern of more selective exploitation of local raw materials parallels that highlighted at the Balzi Rossi sites, and is also mirrored by the data from the primary acquisition site of Monte Avena where both Mousterian and Aurignacian occupations were discovered (Lanzinger 1984; Lanzinger and Cremaschi 1988).

Other northern sites

The Late Mousterian assemblages from Ghiardo Cave and from the Ex-Birreria site of the Balzi Rossi reinforce the interpretation of the Mousterian as a very locally-focused adaptive strategy overwhelmingly dominated by the more or less indiscriminate exploitation of locally available lithotypes (Negrino 1998-2002). On the other hand, Aurignacian assemblages from sites such as Pontecosi (Negrino and Tozzi 2001) and Lemignano (Ghiretti *et al.* 1991) strengthen the case that this industry represents an adaptive strategy making the best use of locally available raw materials while remaining part of a much broader social network, as reflected by the significant presence of exotic raw materials carried over considerable distance. It should be noted, however, that the Aurignacian at Lemignano – which is located next to abundant sources of fine-grained raw material – has yielded very little evidence for long-distance stone procurement.

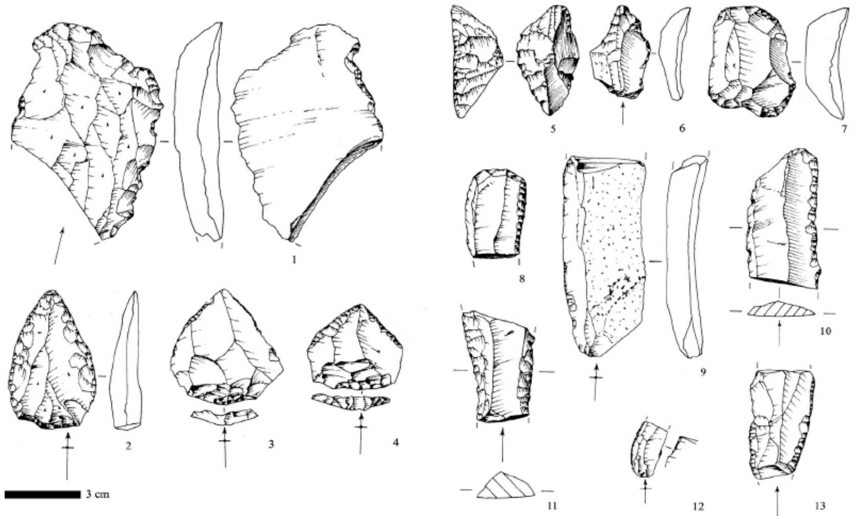


Figure 12.2. Mousterian (1–4) and Aurignacian (5–13) artifacts from Ronco del Gatto (after Negrino 1998-2002). 1: denticulate; 2 and 4: convergent sidescrapers; 3: retouched Levallois point; 5: double nosed carenated endscraper; 6: endscraper-bec; 7: short frontal endscraper; 8: long frontal endscraper with lateral retouch; 9: large marginally retouched cortical blade; 10: retouched blade; 11: "strangled" blade; 12: bladelet with marginal inverse retouch; 13: blade with bilateral retouch.

Two sites merit further mention in a consideration of the behavioral patterns evident during the transition in northern Italy. First, the Late Mousterian site of Via San Francesco, in San Remo, is an enigmatic and so-far unique assemblage (*contra* Bachechi 2001) characterized by a *bone fide* blade industry with clear leptolithic typological tendencies (Figure 12.3; see also Tavoso 1988). Despite these allegedly "progressive" characters, however, the raw material pattern of almost exclusively local raw material procurement firmly anchors this assemblage in the regional Mousterian pattern. The lithotypes identified in the Via San Francesco assemblage, which comprise quartzarenite, fine-grained limestone and rare examples of quartzite, are all readily available in the site's vicinity as rolled river cobbles. Another local lithotype is a grayish-green flint, likely present in local beds of Eocene deposits. The only exotic materials are represented by rare pieces of Ciotti flint and a single tool on French flint likely coming from the Vaucluse (Negrino 1998-2002, 58).

The second site is the well-known cave site of Fumane, in the Veneto, which comprises both Mousterian and Aurignacian assemblages (Bartolomei *et al.* 1992;

Broglio and Cremaschi 1999). In contrast to most other northern sites, however, both industries are almost completely made on varieties of flint available either locally or circumlocally in the eastern Lessini Mountains. For instance, in a discussion of proto-Aurignacian bladelet production at Fumane, Broglio *et al.* (2005) mention that none of the cores and a mere 1% of bladelets are made on radiolarite, the only documented allochtonous lithotype. This attests to a very localized raw material procurement strategy in both periods, suggesting that other kinds of artifactual evidence, such as ornaments, may be better monitors of links to wider social networks than lithic assemblages alone (see Fiocchi 1999). On the basis of raw material transfers, however, there does not appear to have been an important difference between the effective socio-geographical ranges of the Mousterian and Aurignacian occupants of Fumane.

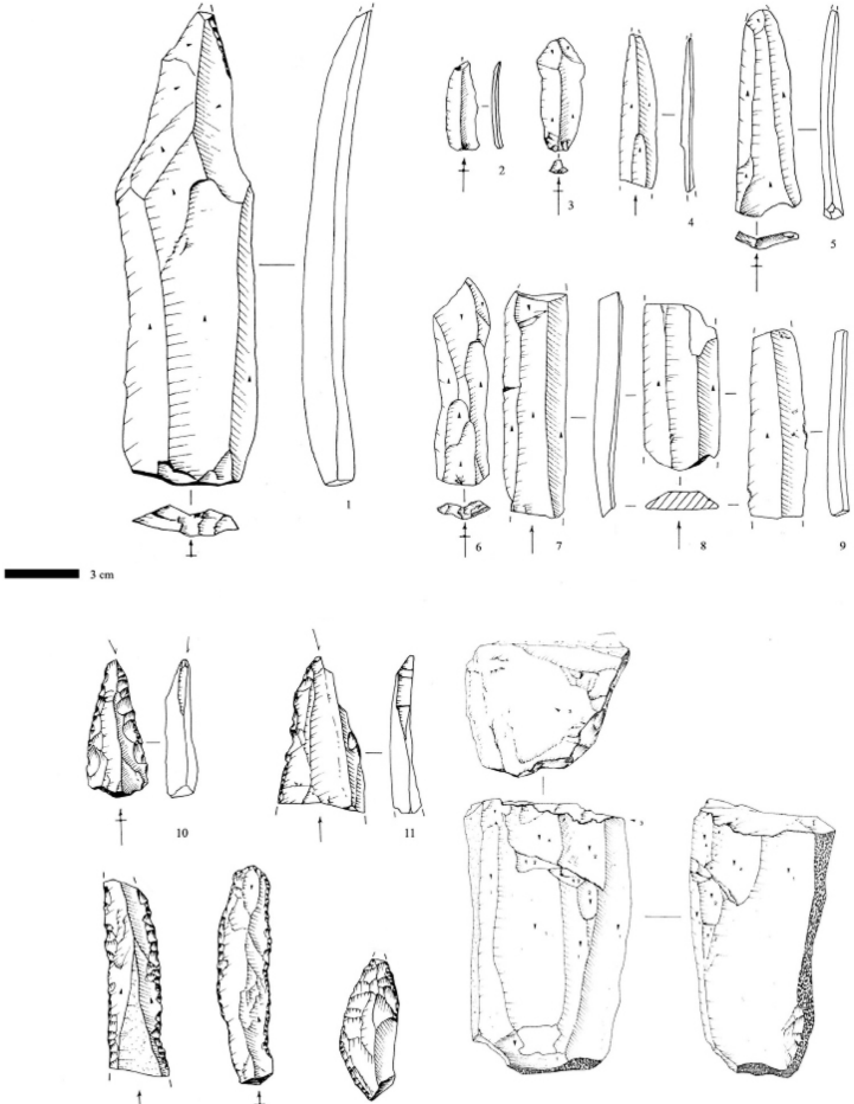


Figure 12.3. Late Mousterian laminar industry from Via San Franceso in San Remo (after Negrino 1998-2002). 1: large quartzarenite blade with abrupt distal retouch (partially backed knife); 2, 3, 7, 9: blades on quatrzarenite; 4, 5, 6, 8: blades on limestone; 10: burin on Vaucluse (?) flint; 11: burin on local flint; 12: denticulate on local flint; 13: denitculated endscraper on fine-grained quartzarenite; 14: quartzite sidescraper/point; 15: limestone prismatic blade core.

Summary of northern data

The picture that emerges from this synthesis of data from the north of the peninsula is relatively coherent, though it bespeaks considerable evidence for local variability in raw material transfer patterns. In all cases, local material dominates in both Mousterian and Aurignacian assemblages. All of the Aurignacian assemblages display evidence of systematic exploitation of the better quality local lithotypes, however, a fact that may have been due to a greater dependence on fine-grained material to minimize chances of failure during blade and especially bladelet production (Negrino 1998-2002). Additionally, the frequency and diversity of exotic lithotypes tend to increase markedly in northern Italian Aurignacian assemblages, although cases such as Lemignano and Ronco del Gatto demonstrate that this is not necessarily always the case. Recent evidence for raw material transfers of over 150 km in the Mousterian of Riparo Bombrini (Holt *et al.* 2003; Negrino and Starnini 2003) also demonstrate that long-distance transfers could be part of the Mousterian behavioral repertoire, although their low frequency is a separate research question requiring further investigation to fully explain. If we accept the precept that longer transfer distances reflect more far-ranging social geographies for Late Pleistocene toolmakers, however, it does appear that, after roughly 40 ky BP in northern Italy, the ability to depend on large-scale social networks – present at least in semi-latent form in Mousterian times – became much more visibly expressed by, and therefore presumably much more crucial to the survival of foragers in that part of the peninsula.

The Transitional Record in Central Italy

The sample of central Italian assemblages on which to reconstruct raw material transfer patterns across the Transition is unfortunately small and limited to sites on the Tyrrhenian coast. We exclude the putative Aurignacian assemblage from Grotta Salomone in Abbruzzo due to its extremely small size and unclear depositional history (see Radmilli 1977) and we also disregard open-air surface assemblages such as Pratica di Mare in Lazio because of their uncertain context. As well, the surface assemblages from Sugherone and the Cinquemiglia open-air sites are not included in our discussion since they remain for all intents and purposes unpublished, aside from very general observations.

Pitti *et al.* (1976) described the La Fabbrica Transitional sequence as containing an Uluzzian (Layer 2) and proto-Aurignacian (Layers 3–4), although Bietti and Negrino (2007) have convincingly demonstrated that the assemblage from Layer 2 is in reality more likely to be a Late Mousterian, despite a dearth of radiometric dates. While the lowermost Mousterian (Layer 1) remains undescribed, the assemblage from Layer 2 is described (Pitti *et al.* 1976, 186) as made mainly on local chert and quartz (the latter of which accounts for over 20% of the debitage but very few of the tools), both of which are described as probably local lithotypes of poor workability. Flint and quartzite, presumably from more distant, perhaps circumlocal sources, are also documented, but are very rare. The exploited materials remained essentially the same during the proto-Aurignacian (Layers 3-4), although flint is described as slightly more frequent than in the underlying assemblage (Pitti *et al.* 1976, 194). A recent reanalysis of a sample of La Fabbrica's Transitional assemblages (*i.e.* Bietti 2006; Bietti and Negrino 2007) indicates that exotic lithotypes account for less than one percent of the Layer 2 assemblage, while they are nearly ten times as frequent in the overlying proto-Aurignacian assemblages. Overall, then, the picture we get from La Fabbrica is broadly concordant with the general pattern identified over the Transition interval in more northerly sites.

Further to the south, Layer 7 of the site of Grotta Breuil on Mt. Circeo (see Alhaique *et al.* 1998, 2000 for recent summaries) has yielded a Late Mousterian characterized by a high incidence of the Levallois technique, somewhat different from the "Pontinian" Mousterian that characterizes the region as a whole (Kuhn 1995). This assemblage has been dated by ESR to about 33 ± 4 ky BP (Alhaique *et al.* 2000), making it very recent and almost contemporary with the recently reported very Late Mousterian of Gorham's Cave, Gibraltar (Finlayson *et al.* 2006). The lithic industry is dominated by convex sidescrapers made on blanks obtained through Levallois reduction methods and the bipolar reduction of locally available flint pebbles aimed towards the production of elongated, almost laminar flakes (Bietti and Grimaldi 1996; Kuhn 1995). Alhaique *et al.* (2000, 111) argue that this represents a local "transitional" industry with undeniable Mousterian affinities, an observation reinforced by the almost exclusively local raw material procurement patterns dominated by the exploitation of small beach pebbles and, in very rare cases, circum-local flint of poor quality.

The only well-published site from Mt. Circeo to contain both Mousterian and Aurignacian assemblages is Grotta del Fossellone (Blanc 1938; Blanc and Segre 1953). Vitagliano and Piperno (1991) describe the assemblage from layer 27b as a Late Mousterian very rich in denticulates and scrapers which, like that of Grotta Breuil, is rather different from the "Pontinian" Mousterian prevalent in the area. Regarding its raw material composition, this assemblage shows an almost complete reliance on local flint beach pebbles. The Aurignacian assemblage from Fossellone (Layer 21) represents an original local facies of the industry rich in endscrapers and split-base bone points denominated "Circean" due to its distinctive appearance derived from the use of small-sized beach pebbles as the main source of raw material (Blanc and Segre 1953). While mainly known in typological terms (*e.g.* Laplace 1966), more recent work presents a complementary analysis of the technological aspects of this assemblage (*i.e.* Bietti 1998). These data indicate that cores were made almost exclusively (98.4%) on local and circumlocal (1.6%) material, while all of the abundant and rather diverse splintered pieces of the assemblage (interpreted as bipolar cores) are on locally available beach pebbles. Insofar as "undetermined" raw material may or may not be local, non-local lithotypes must be seen as comprising anywhere from 6.0-35.1% of the debitage excluding the debris, with strong indications that the higher figures are the more realistic ones (Bietti 1998, 564). While they are impossible to actually quantify on the basis of the available data (Bietti 1998, 567, Table 12. 2), the retouched pieces display two distinct patterns. On one hand, over half of all endscrapers (of both simple and carinated/nosed types) and sidescrapers are made on longitudinal blanks derived from bipolar reduction of locally available pebbles (with 26-47% on "undetermined or exotic lithotypes). On the other, a minority of retouched blades (14%) are unambiguously made on local pebbles, with 36-86% of them made on material that may come from sources up to 200 km away.

While these figures remain estimates, it seems fair to say that in southern Lazio, much like in the north of the peninsula, exotic raw material was much more systematically and extensively exploited during the Aurignacian than in the Mousterian. The Mousterian and Aurignacian material from Grotta Barbara is still largely unpublished, but preliminary reports (*e.g.* Mussi and Zampetti 1990-1991;

Zampetti and Mussi 1988) indicate that they bear strong similarities to the comparable assemblages from Fossellone, although none of the bone points from Grotta Barbara retain their bases. Overall, then, it appears that the central Italian Transitional record largely conforms to the expectations derived from our analysis of northern Italian data, with the Mousterian representing mainly local procurement and the Aurignacian yielding clear evidence of more frequent and more far-ranging procurement of exotic lithotypes.

The Transitional Record in Southern Italy

Our analysis of raw material patterns in southern Italy is restricted by the range of published data since, except for Grotta di Castelcivita, most published accounts of raw material procurement patterns in that part of the peninsula come in the form of qualitative descriptions which cannot be quantified or directly compared to data from other sites. We therefore start with a discussion of the Castelcivita data and subsequently complement it with patterns from a recent reanalysis of the Uluzzian assemblage from Grotta del Cavallo undertaken by one of us (JR-S). These combined patterns are finally used to generate a qualitative assessment of raw material transfer patterns that can then be compared *grosso modo* to patterns from other southern Italian sites.

In terms of data selection, a number of surface assemblages attributed to the Mousterian (*e.g.* Falce del Viaggio), Uluzzian (*e.g.* Tornola, Torre Testa) and Aurignacian (*e.g.* Caruso, Punta Safò) were not considered here because they failed to meet the selection criteria outlined earlier in this paper. We also excluded the putative Aurignacian assemblage from Fontana Nuova di Ragusa (Chilardi *et al.* 1996; Gioia 1984-1987) because of its poorly understood excavation methods (see Bernabo Breà 1950) and because it contains very few Aurignacian industrial diagnostics. This latter problem has led other knowledgeable Italian prehistorians to argue that it is more likely, in fact, to be an Epigravettian assemblage (*e.g.* Bonfiglio and Piperno 1996; Palma di Cesnola 1993, 139). Likewise, since it remains unpublished, the recently reported Aurignacian assemblage from Grotta della Serratura (see Martini *et al.* 2000-2001, 140) was disregarded in this analysis. Lastly, on the basis of the results of a recent reanalysis that disproved the hypothesis that Layer D at Cavallo represents the mixing of Aurignacian and Uluzzian assemblages (*i.e.* Riel-Salvatore 2004, in press), we consider all of the Cavallo Early Upper Paleolithic assemblages as being unquestionably Uluzzian.

The southwest: Grotta di Castelcivita

Table 12.3 displays the raw material procurement patterns of the four assemblages from Castelcivita, where the exploited lithotypes include flint, chert, fine-grained quartzite, quartz and limestone. Flint clearly constitutes the preferred material, accounting for the vast majority of all lithics in the four assemblages, and climbing to over 90% for the Aurignacian retouched tools. In the Uluzzian, the difference is made up by an increased reliance on limestone, while the difference in the Mousterian assemblage is made up mainly by chert and quartzite. Chert, quartz and quartzite all appear in relatively low numbers compared to flint, and while these materials are ultimately of allochtonous origins, they can nonetheless also be found as cobbles in the Calore River. Limestone is an immediately locally available lithotype, being found in the talus in front of the site in the form of angular cobbles, but the way in which it was worked indicates that this raw material is perhaps best considered separately from the other ones documented at the site (Gambassini 1997b).

Table 12.3. Raw material frequencies for the retouched tools (ret.) and the debitage (unret.) of each of the Castelcivita assemblages (data from Gambassini 1997b). Note that, except for N, all values are percentages. P-A = proto-Aurignacian.

	Mousterian		*Uluzzian*		*P-A w/Dufour*		*P-A w/Castelcivita*	
	Ret.	*Unret.*	*Ret.*	*Unret.*	*Ret.*	*Unret.*	*Ret.*	*Unret.*
Flint	82.7	82.8	81.0	72.1	96.1	90.6	95.6	82.6
Chert	4.5	5.3	1.5	0.2	0	0.4	0.7	2
Quartzite	12.3	8.7	1.8	3.2	1.3	2.5	2.2	1.9
Quartz	0.0	0.0	1.3	0.6	0	0	0	0
Limestone	0.4	3.1	14.3	23.9	2.6	6.5	1.5	13.5
N	446	1498	775	3689	465	1894	321	1092

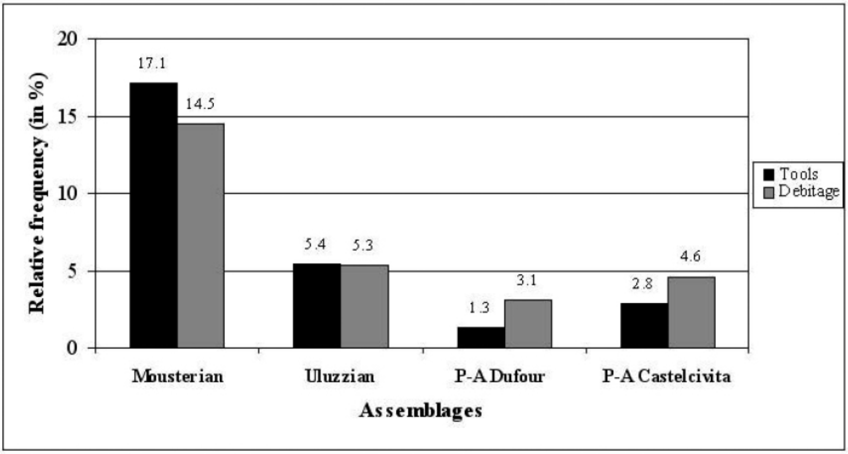


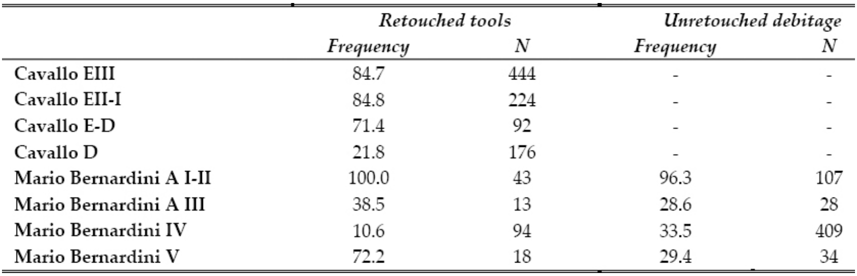
Figure 12.4. Incidence of non-limestone lithotypes other than flint in the Castelcivita assemblages. Data from Gambassini (1997b).

Figure 12.4 presents the breakdown of the importance of flint versus other non-limestone lithotypes in the Castelcivita assemblages, and it appears that the Uluzzian and proto-Aurignacian display a comparably overwhelming concentration on flint to the near exclusion of all other known lithotypes. In contrast, the Mousterian focused noticeably less intensively on flint, incorporating especially large amounts of quartzite and chert. Without a comparative “naturalistic sample” of lithotype representation in the Calore River, it is hard to determine if these patterns demonstrate a conscious effort by Mousterian toolmakers to select lithotypes other than flint more frequently or an active selection of flint over other rocks by Uluzzian and proto-Aurignacian toolmakers, or both. What seems clear, however, is that the Mousterian pattern is distinct from that which characterizes both the Uluzzian and the proto-Aurignacian. It is also possible that this demonstrates a more targeted exploitation of locally available lithotypes starting with the Early Upper Paleolithic geared towards the systematic exploitation of finer-grained varieties. Indeed, at Castelcivita, the makers of Uluzzian and proto-Aurignacian assemblages appear to have used finer-grained varieties of local resources than they did in the Mousterian, which is intriguing given that the Uluzzian is thought to have been the handiwork of Neanderthals (Churchill and Smith 2000, Kuhn and Bietti 2000, Palma di Cesnola 2004).

The southeast: The Uluzzian of Grotta del Cavallo

Uluzzian assemblages from Grotta del Cavallo, the industry's type-site (Palma di Cesnola 1966, 1967, 1993), may be of help in testing the significance of the pattern highlighted at Castelcivita. The Cavallo assemblages have recently been reanalyzed by one of us, and these new data form the basis of the discussion presented here (Riel-Salvatore 2004, in press). Importantly, this reanalysis has demonstrated a lack of support of the idea that the assemblage from Layer D represents a mix of Uluzzian and Aurignacian artifacts (*contra* Gioia 1988, 1990), meaning that the raw material procurement patterns of all four assemblages can confidently be said to characterize the Uluzzian. The lithotypes identified at Cavallo include flint, chert, quartzite, limestone and thin slabs of poor-quality siliceous limestone known in Italian as *liste*. Of these materials, only limestone and *liste* have been reported as being available near the site (Sarti *et al.* 1998-2000, 2002), though it should be stressed that their exact provenience is not known. In contrast, despite well over a century of archaeological research in the Salento (the region where Grotta del Cavallo is located), no sources of flint, chert or quartzite are known in the area (R. Grifoni-Cremonesi, pers. comm. 2005; see also Milliken 1998, 1999–2000, 60). While some prehistorians have argued that sources of fine-grained materials may exist in Cretaceous outcrops located some 30 km east of the site (Bietti 2003, 48), currently available data lend more support to the assumption that fine-grained materials would have had to be imported over considerable distances (250+ km), from sources to the north located either in the Gargano promontory or the Basilicata Apennines piedmont (Milliken 1998, 1999–2000).

Table 12.4. – Relative frequency (in %) of retouched tools and debitage on fine-grained non-local raw material at Grotta del Cavallo and Grotta Mario Bernardini. N refers to total counts for each lithic subcategory.



	Retouched tools		*Unretouched debitage*	
	Frequency	*N*	*Frequency*	*N*
Cavallo EIII	84.7	444	-	-
Cavallo EII-I	84.8	224	-	-
Cavallo E-D	71.4	92	-	-
Cavallo D	21.8	176	-	-
Mario Bernardini A I-II	100.0	43	96.3	107
Mario Bernardini A III	38.5	13	28.6	28
Mario Bernardini IV	10.6	94	33.5	409
Mario Bernardini V	72.2	18	29.4	34

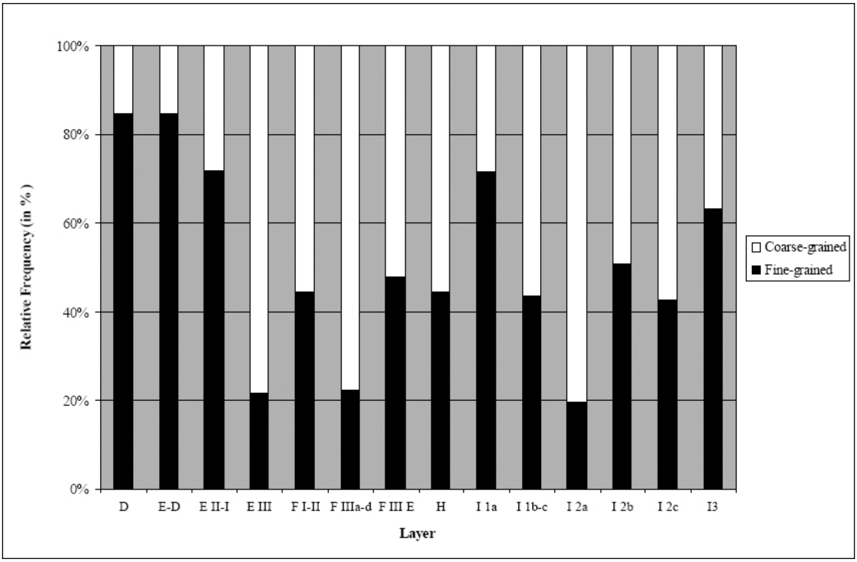


Figure 12.5. Proportions of fine- and coarse-grained materials in the retouched tool assemblages from Grotta del Cavallo. Uluzzian assemblages = D to E III. Data for the Mousterian from Sarti et al. (1998–2000, 2002).

Whatever the case may be, however, it is unquestionable that raw material procurement patterns for the Uluzzian at Cavallo indicate increasing dependence on fine-grained non-local lithotypes over time (Table 12.4). The importance of this pattern is bolstered by comparisons to the procurement patterns of the underlying Mousterian layers, where fine-grained materials usually account for less than 40% of the assemblages, only surpassing the 50% mark in two of Cavallo's ten Mousterian layers (Figure 12.5). Needless to say, this pattern of increased dependence on distant sources of raw material over time does not agree well with scenarios that sees the Uluzzian as simply the result of acculturation of Mousterian-making Neanderthals increasingly restricted to isolated refugia by the Aurignacians (whomever they may be) as they inexorably advanced southwards across the landscape.

The combined patterns from Cavallo and Castelcivita enable the formulation of an empirically-grounded qualitative assessment of raw material procurement patterns in southern Italy and, by extension, of the geographical ranges of the makers of Early Upper Paleolithic industries in that part of the peninsula. Contrary to the patterns evidenced in the north, the meridional Aurignacian appears to depend mainly on local sources of raw material, incidentally the same ones utilized by Mousterian and Uluzzian occupants of the same sites. As well, the Uluzzian appears characterized by a desire to exploit fine-grained material whenever possible, obtaining it over great distances if necessary. The differences in the Uluzzian raw material exploitation patterns between Castelcivita and Cavallo also highlight the need to consider contextual information in order to accurately interpret the meaning of differences in transfer distances. Lastly, the Castelcivita pattern indicates that, at sites where they co-occur, Aurignacian and Uluzzian assemblages can display nearly identical raw material procurement strategies, in this case both exploiting preferentially similarly local raw materials.

Other southern Italian Early Upper Paleolithic assemblages

These trends allow us to generate a set of qualitative expectations to assess raw material procurement patterns found in published on comparable southern Italian assemblages. Benini *et al.* (1997) explicitly state that the Uluzzian and Aurignacian assemblages from Grotta della Cala display broadly similar raw material exploitation patterns, which is in accordance with the model outlined above. These assemblages are dominated by local lithotypes, including beach pebbles of poor-quality flint that abound near the site (accounting for 62% of retouched pieces and 70+% of the debitage) and limestone (2.5% of retouched tools and 10% of debitage). Exogenous fine-grained chert from an unspecified location(s) is also present, however, accounting for 31% of retouched and 18% of unretouched pieces. The preferential selection of the exotic lithotype for retouched blanks strongly suggests its high desirability for both the Uluzzian and Aurignacian toolmakers (Benini *et al.* 1997, 51-52), and provides evidence of a noticeable exploitation of non-local resources during the Early Upper Paleolithic of the region that distinguishes it from the pattern of comparable assemblages at Castelcivita.

The Aurignacian assemblage from the stratified open-air site of Serino is dated to 31,200 ± 650 BP (Accorsi *et al.* 1979), and its lithic assemblage is described as quite similar to the proto-Aurignacian with Castelcivita bladelets found at the eponymous site. From the perspective or raw material exploitation, the industry is dominated by flint likely present as water-worn cobbles on the shore of the paleolake on which the site was located. A very small number of tools and pieces of debitage made on reddish and greenish cherts are also reported. That the “tools” on chert are mainly splintered pieces (Accorsi *et al.* 1979) indicates that this material may have been perceived as more valuable than local flint cobbles by the toolmakers at Serino, since these artifacts are often interpreted as exhausted cores (see Shott 1999; cf. Villa *et al.* 2005). The use of this reduction method coupled with chert’s low representation strongly hints at the fact that this lithotype was probably non-local in nature and imported from a certain distance away, although the absence of quantified data makes it hard to assess its exact prevalence at Serino.

In the southeast of the peninsula, the only unambiguous stratified Aurignacian assemblages come from Grotta Paglicci on the Gargano promontory, and they date to between 29,300 ± 600 BP and 34,300 ± 800 BP (Palma di Cesnola 2003a, 2006). All three assemblages are described as made on high-quality flint that outcrops roughly 30 km from the site (Palma di Cesnola 2003b, c). The same kind of material has been reported to dominate most of the mainly open-air Mousterian assemblages found in the area (Milliken 1999-2000, 51; Palma di Cesnola 1996, 181-187). Neither the preliminary descriptions of these layers (Palma di Cesnola 1991, 1992, 1993) nor the definitive report on the site’s Aurignacian industries (Palma di Cesnola 2003c, 2006) mention the presence of exotic raw materials in the assemblages. This lends credence to a characterization of their raw material procurement strategy as probably mainly local in nature. This time-transgressive pattern accords well with the data about Aurignacian exploitation patterns elsewhere in southern Italy.

The only other stratified early Upper Paleolithic assemblages in southeastern Italy are found in the Salento peninsula, not far from Grotta del Cavallo (Kuhn and Bietti 2000; Palma di Cesnola 1993; Riel-Salvatore and Barton 2004). All of these assemblages are described as Uluzzian, an attribution now beyond dispute in light of the recent demonstration that none of the Cavallo Uluzzian assemblages are mixed with Aurignacian ones (Riel-Salvatore 2004, in press). It is important to emphasize this, since claims for such an admixture was the main reason invoked by some to cast doubt on the integrity of neighboring Uluzzian assemblages (Gioia 1988, 1990; Mussi 1990, 2001). The only credible instance of an Aurignacian presence in the Salento is represented by the two uppermost levels from Serra Cicora A, variously attributed to the proto-Aurignacian (Spennato 1981) or the "Uluzzo-Aurignacian" (Palma di Cesnola 1993). Regardless of their putative "cultural" attribution, however, recent work suggests that all Early Upper Paleolithic assemblages from the Salento appear to have conformed to a very similar flexible behavioral strategy and to have exploited the same sources of fine-grained lithotypes as those documented at Cavallo (Riel-Salvatore and Barton 2004, 264-266 and Figures 2, 3). Data from the same study indicate that the Uluzzian assemblages from Grotta Mario Bernardini (Table 12.4; see also Borzatti von Löwenstern 1970, 1971) display aggregate frequencies of flint, chert and quartzite of 10.6 to 100% (average 55.3%) for retouched tools, and of 28.6 to 96.3% for the debitage (average 43.9%). This indicates that fine-grained lithotypes were also preferentially selected for retouch and curation by both Uluzzian and proto-Aurignacian toolmakers in the area. In contrast, the Mousterian assemblages from the same and neighboring sites (*e.g.* Grotta di Uluzzo C – see Borzatti von Löwenstern 1965, 1966) display frequencies of fine-grained material of 8.3 to 64.3% (average 32.5%) in their retouched tools and of 0 to 61.8% (average 13.7%) for the debitage. This pattern indicates that while fine-grained raw materials were also preferentially retouched and curated during the Salentine Mousterian, these lithotypes were much less intensively exploited. While more data are needed to establish this interpretation, this disparity may represent evidence of better strategies for provisioning sites in the Salento with fine-grained lithotypes in Uluzzian times, as opposed to the "provisioning of individuals" (*sensu* Kuhn 1992, 1995) that may have characterized the local Mousterian.

Summing up, the Early Upper Paleolithic of the Salento is marked by a shift towards a greater exploitation of exotic fine-grained stone than during the Mousterian. While the source of these lithotypes does not appear to have changed, its relative frequency became dramatically more important at that time, a pattern which stands in stark contrast to the Early Upper Paleolithic patterns elsewhere in southern Italy which were characterized by a heavy reliance on locally available raw materials complemented by a minor component of finer-grained and presumably non-local materials. It therefore appears that the record of southern Italy documents two distinct raw material exploitation patterns. On the one hand, all southwestern Early Upper Paleolithic assemblages, along with the three Aurignacian assemblages from Paglicci, appear to represent an extremely locally-based adaptive system, with little evidence for extensive social networks. On the other hand, the Uluzzian lithotype transfer pattern in the Salento in the southeast bespeaks an increased dependence on nonlocal fine-grained lithic raw materials which currently available data indicate may have come from several hundred kilometers away. This suggests a dramatic reorganization of the manner in which necessary resources were acquired by hunter-gatherers during that period, likely through the establishment (or at the very least the substantial reinforcement) of wide-ranging social networks, if the traditional tenets of long-distance procurement are to be believed. Since all currently available fossil data seem to associate the Uluzzian to Neanderthals (Churchill and Smith 2000; Gambassini *et al.* 2005), these conclusions stand in sharp contrast to the expectations of traditional models of the acculturation and ultimate demise of the Neanderthals in Italy (*e.g.* Palma di Cesnola 2004).

Interestingly, this lack of adherence to the traditional acculturation model is also manifest in two other dimensions of the "transitional" archaeological record of southern Italy. The first concerns the prevalence of the archaeological "markers" of the Aurignacian included in most typical trait-list approaches and assumed to represent the first evidence of behavioral modernity, namely ornaments, coloring materials, organic technologies, and spatial organization. With the exception of two fragmentary bone points and "numerous pierced shells" from the Aurignacian levels of La Cala (Benini *et al.* 1997, 51), in southern Italy, it is the *Uluzzian* which is associated with the vast majority of such evidence: Serino and Paglicci have yielded none of this range of evidence whatsoever, while the record of the proto-Aurignacian of Serra Cicora A comprises only a fragmented bone awl and faint traces of ochre (Spennato 1981), a record which pales in comparison to the abundant osseous industry and numerous pieces of coloring materials recovered from Uluzzian layers at Cavallo (Palma di Cesnola 1993; Riel-Salvatore 2004), Mario Bernardini (Borzatti von Löwenstern 1970, 1971) and Uluzzo C (Borzatti von Löwenstern 1965). The same is also true at Castelcivita where more organic implements have been found in the Uluzzian deposits than in the overlying Aurignacian ones, and where "structures" (*i.e.* post holes) have only been identified in the Uluzzian layers (Gambassini 1997b, 121). This is in addition to evidence that a broader spectrum of animal resources, including fish, appears to have been exploited in the Mousterian and Uluzzian of Castelcivita than in either of the proto-Aurignacian levels (Cassoli and Tagliacozzo 1997). This pattern is starkly different from that evidenced in the north and center of the peninsula where Aurignacian assemblages display numerous examples of all these traits in much greater frequencies than the Mousterian (see *e.g.* Kuhn and Stiner 1992, 1998).

The second set of data that goes against traditional assumptions of the Transition in southern Italy is provided by recent analyses which suggest that the Aurignacian and Uluzzian may be much older than previously thought (*e.g.* Fedele *et al.* 2002, 2003; Riel-Salvatore *et al.* 2006). If correct, this revised chronology has two very important implications for our understanding of the Transition in Italy. First, the Uluzzian may well have developed in the south of the peninsula independently of any Aurignacian influence, direct or indirect (Riel-Salvatore *et al.* 2006). Second, when it took place, the diffusion of the Aurignacian in the peninsula would have been considerably more fast-paced than usually thought, being virtually instantaneous throughout the peninsula, or perhaps just slightly later in the south. These observations bear heavily on prevalent conceptions of the Uluzzian, since they imply the independent appearance of two very distinct technocomplexes in Italy at the beginning of the Early Upper Paleolithic.

While we soon hope to be able to publish more conclusive data about the chronology and behavioral features of the Uluzzian to clarify these issues, we cannot on the strength of current evidence accept at face value traditional models that see the Aurignacian simply expanding gradually from north to south and displacing Neanderthals who created the Uluzzian as a last-resort attempt to adapt to the new socio-geographical realities of the Early Upper Paleolithic. Rather, the data seem to suggest that the Uluzzian and Aurignacian, insofar as they are represented by stratified assemblages, were present in different parts of the peninsula, with the Uluzzian originally present in all of its southern third and tenaciously occupying the Salento peninsula after the appearance of the Aurignacian in southeastern Italy. That the Salentine Uluzzian depended so heavily on lithotypes that may have come from the Gargano, which as the Paglicci record suggests was "Aurignacian territory", implies that there must have been repeated – and likely not only inimical – contacts between makers of the Uluzzian and Aurignacian. This suggests that Early Upper Paleolithic population dynamics in the Italian peninsula were partaken into by groups that likely saw each other as equally "human," with all that entails in terms of potential social relations.

Discussion and Conclusions

Returning to our original goal of testing the hypothesis that long-distance raw material transfers are a diagnostic feature of the Aurignacian, what does the evidence presented above allow us to say about that feature of the archaeological record – and by extension about the putative socio-geographical ranges of their makers? First, using the whole peninsula as an analytical unit underscores the critical importance of using meaningful geographical units in order to adequately capture the full range of variability that characterizes specific behavioral patterns. In this case, looking at continental Italy as a whole - a widely recognized discrete geo-ecological unit (Finlayson 2004; Gamble 1999) – brings forth patterns that both agree and disagree with the expectations of the dominant model of the replacement of Neanderthals by modern humans. In fact, it appears that the traditional expectation of more frequent long-distance transfers in the Aurignacian is only valid in the north of peninsula, and then not in all cases (see also Bietti and Negrino 2007, Figure 12 for detailed maps of raw material transfers). In the south, in contrast, it is only Uluzzian assemblages that are associated with such transfers. In other words, this study demonstrates the empirical insufficiency of increased raw material transfers as a marker of modern human behavior as traditionally conceptualized, especially since all available fossil evidence associates the Uluzzian exclusively with Neanderthals. It is doubly unexpected to find so little evidence of long-distance lithotype transfers in the southern Italian Aurignacian in light of the observation that this region is precisely where "modern behavior" (as represented by the various material correlates of trait-list approaches) could be expected to have been most prevalently expressed, in order to explain the alleged displacement of Neanderthals by modern humans. Given that is is highly unlikely that the absence of long-distance lithotype transfers precludes the modernity of the makers of the southern Italian Aurignacian, we find it hard to justify using this behavior as a defining trait of modernity. Based on this evidence and recent arguments about the chronology of the Early Upper Paleolithic in Italy, we would therefore like to tentatively suggest that the Transition may not have been the simple north-to-south time-vectored phenomenon it has often been portrayed as in the Italian peninsula, and that renewed research is needed to clarify its nature in peninsular Italy.

At this point, the contrasting raw material transfer patterns in northern and southern Italian Aurignacian assemblages likely indicates the general lack of attention that has been paid to contextual factors in studies that have attempted to frame behavioral change in the Early Upper Paleolithic. It is undoubtedly easier to fold data into the interpretive niches defined by “grand models” of human origins, but what are we to do when our data display a patent lack of fit with the precepts of such models? Rather than continue to dogmatically interpret long-distance raw material procurement as evidence of behavioral modernity however defined, we would suggest that we can obtain much more useful information on multiple facets of Late Pleistocene lifeways by exploring the meaning of the greater or lesser expression of this – and other – behaviors in the broader socioecological context of individual assemblages. The data presented in this paper are currently insufficient to resolve the issue of the emergence of modern behavior in Italy. They do, however, highlight the importance of employing geographically meaningful analytical units to get a sense of the true range of empirical variability that characterizes this research question. They also raise serious doubts about the heuristic validity of long-distance raw material transfers as a marker of behavioral modernity. What they *do* allow us to say, however, is that over the course of the 45-30 ky BP interval, the Italian peninsula is perhaps best understood as a landscape of new ideas engaging entrenched Late Pleistocene geo-cultural realities, resulting in a complex behavioral mosaic only coarsely transmitted to modern researchers through the archaeological record. As our data have shown, the resulting human dynamics were more complex than usually recognized and it is therefore not surprising that their archaeological signatures do not necessarily fit very well in the traditional models developed by previous generations of prehistorians. If we are to refine our understanding of the Transition in Italy, a first step will be the acquisition of reliable data from unexplored zones in Italy such as Abruzzo and Molise in the center and Basilicata in the south. Secondly, and perhaps most importantly, it is imperative to develop interpretive frameworks that can accommodate these new data as well as the archaeological variability we already know exists. Only then will we be able to reconstruct and appropriately contextualize the behavior of the makers of the industries that compose the multifaceted record of the Italian Early Upper Paleolithic and integrate these insights in broader, pan-Mediterranean outlooks on modern human origins.

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13. From regional patterns to behavioural interpretation: Assessing the Middle to Upper Palaeolithic transition in Mediterranean France

Carolyn Szmidt

Abstract

The transition from the Middle Palaeolithic to the Upper Palaeolithic period marks a time during which, in a number of regions in Europe, substantial changes in many aspects of behaviour are noted. This period of transition has not, however, been examined in detail in Mediterranean France from a multi-site, regional-scale perspective, despite the fact that numerous Middle Palaeolithic sites are located there and that this region is located right along one of the migration routes hypothesised by some as having been taken by Homo sapiens when they first inhabited Europe.

In this paper, the Middle to Upper Palaeolithic transition in Mediterranean France is investigated in a regional, integrative and comparative way by examining 15 Aurignacian sites (representing 23 assemblages) and 79 Mousterian sites (representing 194 assemblages) in order to evaluate in what ways and to what extent, if at all, the patterns of behaviour changed over the critical Middle to Upper Palaeolithic transition within Mediterranean France regarding certain aspects of the material culture, namely use of non-lithic raw materials, ornaments and decorated artefacts.

Such multi-assemblage, regional-scale comparisons require the merging and comparison of data of sites of differing taphonomic conditions, excavation methodologies and quality. These non-behavioural factors could potentially affect results and must be taken into account a priori in order to avoid making spurious conclusions. The data from the transition in this region are thus evaluated for such factors. The paper demonstrates that the Middle Palaeolithic and Aurignacian do differ with respect to the occurrence of the artefact types considered in this analysis, but that it is difficult to judge the extent of change given the role that taphonomic/excavation factors potentially have on assemblages from this region. The wider implications of this analysis on the evaluation of the Middle to Upper Palaeolithic transition more generally are discussed.

Introduction

In this paper, the Middle to Upper Palaeolithic transition in Mediterranean France is investigated in a regional, integrative and comparative way by examining 15 Aurignacian sites (representing 23 assemblages) and 79 Mousterian sites (representing 194 assemblages) in order to evaluate in what ways and to what extant, if at all, the patterns of behaviour changed over the critical Middle to Upper Palaeolithic transition within Mediterranean France regarding certain aspects of the material culture, namely use of non-lithic materials, ornaments and decorated artefacts

Beginning with a brief presentation of the background and the main theoretical viewpoints held regarding the Middle to Upper Palaeolithic transition more generally, the paper goes on to outlining the relevance of Mediterranean France to these debates and to explaining the assemblage assessment and inclusion criteria used in this analysis. This shall be followed by results and a discussion of the implications of the findings on the evaluation and interpretation of the Middle to Upper Palaeolithic transition in this region and beyond.

Background on Middle to Upper Palaeolithic transition

Across Europe, significant changes in many spheres of behaviour have been reported as having taken place from the Middle Palaeolithic to the Early Upper Palaeolithic, including the first evidence of cave art, figurines, a proliferation of new lithic tool types, systematic use of new lithic technology, the first systematic use of non-stone raw materials such as bone, antler and ivory, the frequent production of personal ornaments and the increased use of distant raw materials, among other changes (Mellars 1989, 2004; Bar-Yosef 2002).

Most argue (Mellars 1989, 2004, 2006a, b; Broglio 1996; Kozłowski and Otte 2000; Bolus and Conard 2001; Harrold and Otte 2001; Conard and Bolus 2003; among others) that these new behaviours are the result of a new group of individuals, namely *Homo sapiens* (although see next section regarding anthropological-archaeological links) spreading westward across Europe with this new culture, carrying it, developing it, and innovating it as they spread, rather than the result of *in situ* local changes by the indigenous Neanderthal populations. This hypothesis is known as the "population dispersal and replacement hypothesis".

The fact that the changes affect a multitude of spheres of behaviour, that these changes appear fairly suddenly (in archaeological terms) across a wide geographical range and that much of these behaviours are either not found at all in the preceding Mousterian or, if sometimes present, constitute either only a sporadic element of this behaviour and/or are present in a form which is very little elaborated, are the reasons which have been put forward to argue that the changes that occurred between 45 000 and 30 000 years ago represent a significant change in behaviour. Proponents of the dispersal and replacement hypothesis argue that during this period we are witnessing a profound 'transition' rather than simply regular, expected, gradual change over time, likely reflecting profound changes in the extent of regional networks, in communication and in social identity (Mellars 1989, 2004; Bar-Yosef 2002).

Alternative views have, of course, been proposed as well. For instance, Zilhão and d'Errico (1999, 2003a, b; Zilhão 2006) agree that the Aurignacian, with its use of bone, antler and ivory technology, particular lithic technology, personal ornaments and art, is very likely to have been the work of *Homo sapiens*, but argue that the indigenous populations (namely, the Neanderthals) independently invented and incorporated a lot of similar and equally significant (yet not identical) changes (as seen especially through the Châtelperronian, with its personal ornaments, blade technology and bone tools), *prior* to the arrival of *Homo sapiens* in Europe. Thus, they believe that we are witnessing profound behavioural changes in two populations independent of each other rather than believing that these revolutionary and significant behavioural changes are unique to *Homo sapiens*. For these researchers, the Châtelperronian is not the result of the acculturation of the indigenous populations by the exogenous ones, but rather was created through independent invention (d'Errico *et al.* 1998; Zilhão and d'Errico 1999).

Nevertheless, despite differing in their views of this key period with those of the researchers mentioned above and, related to this, differing in their view of the timing of the beginning of the Aurignacian, Zilhão and d'Errico (1999) seem to believe, in keeping with the proponents of the population dispersal and replacement hypothesis, that the behavioural changes seen at the Middle to Upper Palaeolithic transition are very significant.

On the other hand, a few researchers have downplayed the importance of this 'transition', arguing that the Middle Palaeolithic and Early Upper Palaeolithic periods are not that different from each other, based essentially on three arguments: (1) that in some regions, Aurignacian assemblages do not include the significant changes mentioned above, or they exist in only very low frequencies (Straus 1990, 2003; Clark 1997); (2) that some of the behavioural changes thought to characterise the Aurignacian are already found in some Middle Palaeolithic and 'Transitional' industries (Cabrera Valdés and Bernaldo de Quiros 1996; Clark 1997; Straus 2005); (3) that the Aurignacian of some regions contains numerous Mousterian elements (Straus 1990, 2003, 2005).

These researchers do not see a significant break at the Middle to Upper Palaeolithic boundary, but instead argue that the large, significant break occurs much later, in the Late Upper Palaeolithic (Solutrean-Magdalenian) when significant contrasts with the Middle Palaeolithic can be clearly noted quantitatively (sheer numbers of such new artefacts being many fold more numerous per site and number of sites) and qualitatively (quality and elaboration of technique) (Straus 1990; Clark 1997). Changes from the Mousterian to the Aurignacian periods are thus seen more as a continuity and the transition as a '[…] monumental non-event […]' (Clark 1997, 42). Thus, this hypothesis is known as the "population continuity hypothesis".

Clearly, one of the ways to resolve which of these radically opposing viewpoints about the Middle to Upper Palaeolithic transition is applicable on a pan-European scale, with all the cognitive, mobility, demographic and social implications that each carries, is to study each region in detail, since the nature and extent of changes may have differed between regions, and only then to step back and compare the results of the regions on a pan-European scale.

To a large extent, differences in viewpoints could relate to the scale of analysis being used from which to draw conclusions. In a specific, very circumscribed, geographical region, perhaps large-scale changes are not manifested in the archaeological record, making it appear as if the Mousterian and Aurignacian are not very different from each other, whereas on a continental, pan-European scale, taking all sites together, such changes are noticed because there are always some sites, somewhere (or many sites in many places depending on the aspect of behaviour examined) that show the new behaviour quite strongly and it is in fact their presence in many locations that makes it significant.

There will, of course, be differences between the Mousterian and the Aurignacian, like there are differences between any two archaeological cultures, by definition, otherwise we would classify them as the same culture. It is also to be expected that there will be variability between sites of the same archaeological culture, for obvious reasons such as differences in group composition, the environment, raw material availability, quality and size, site function of sites and individual maker preferences, to name but a few. So really, it comes down not only to assessing whether there *are* differences between the Middle Palaeolithic and Early Upper Palaeolithic record of each region, but to assessing the extent of differences, in other words, whether any such differences represent only a difference of degree or, more fundamentally, of kind. Then the issue becomes where one draws the line between degree and kind, *i.e.*, how quantitatively and qualitatively different do two cultural repertoires have to be before we say that they are fundamentally different (differences of kind)? A lot of the discussion between replacement and continuity models likely comes down to differences in scale of analysis used to draw inferences and in where one draws the line between difference of degree and kind.

In any case, no matter which of the hypotheses regarding the transition proves to be correct, it is first critical to establish that any differences we do observe are real (due to behavioural differences) not the product of non-behavioural, extraneous, factors such as preservation differences between sites/layers or excavation methodology differences which bias recovery. This is especially critical when dealing with sites showing a lack of (or very low numbers of) particular key artefacts or when using differences in quantity as an argument for significant differences between sites or periods. In assessments of regions where the transition does not seem marked, perhaps it is only an *apparent* similarity between archaeological periods, caused instead by a variety of factors, such as: (1) a lack of extensive research in the region, (2) particular local conditions (environmental, lack of availability of particular raw materials/resources) which prevented certain behaviours from being practised, (3) taphonomic or excavation factors which may have precluded the *recovery* of such behavioural items and a lack of systematic evaluation of these factors. Whether operating one's scale of analysis on a particular region or on a continental scale, these other possibilities must be assessed before conclusions regarding hominin behaviour, such as degree of interaction, dispersal/diffusion paths, identification of centres of innovation (core areas) versus peripheral areas, are drawn.

The remainder of the article will deal with evaluating the transition, including this very point, in the region of Mediterranean France. The importance of this region to the debates on the Middle to Upper Palaeolithic transition will be outlined and the specific details of the criteria used for this analysis, in terms of assemblage assessment and inclusion, will be discussed. This shall be followed by the presentation and discussion of results, first in this region specifically and then within a pan-European perspective.

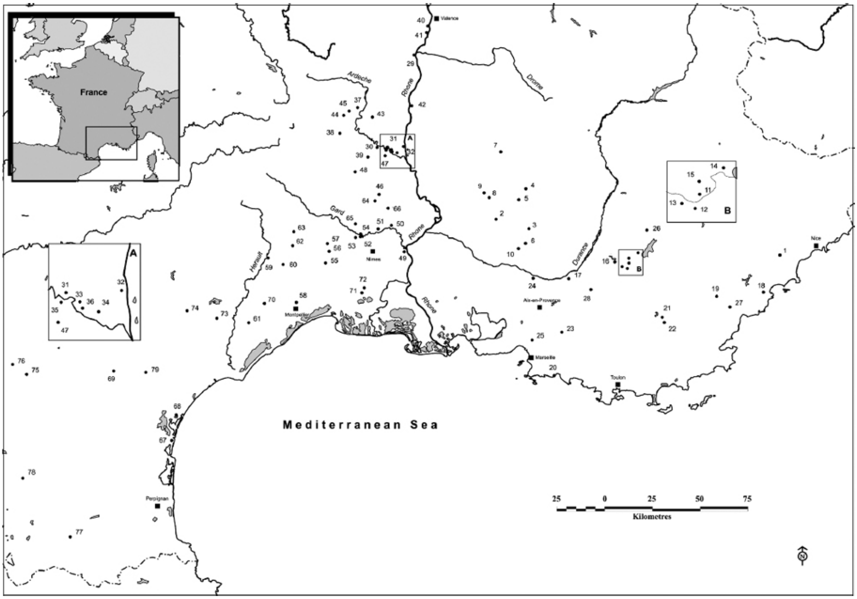
The Mediterranean France region

This is one region where the Middle to Upper Palaeolithic boundary has never been examined in detail systematically across the region in a comparative, multi-site approach.

Mediterranean France (see Figures 13.1 and 13.2) is that part of France which is climatically under Mediterranean influence, defined usually as the region encompassing the present day limit of the olive tree, the limit of green oak or having a Mediterranean climate. It is a region which extends northwards until the modern city of Valence (Moncel 1997, 483). This region is not only a climatic entity, but a geographical one as well, where latitude and longitude are fairly restricted, thus reducing the potential sources of variability of archaeological patterns within it.

It is a region which is delimited by the Massif Central and the Alps to the north, the Alps to the east, the Massif Central and the Pyrénées to the west and the Mediterranean Sea to the south. The administrative departments included in this research are those of Provence (Alpes-Maritimes, Var, Bouches-du-Rhône, Vaucluse, Alpes-de-Haute-Provence, Hautes Alpes) and the department of Drôme east of the Rhône river and, west of this river, most of those in Languedoc-Roussillon (Gard, Hérault, Aude and Pyrénées-Orientales), as well as the department of Ardèche in Rhône-Alpes. Figure 13.1 shows the region examined, the location of all the Mousterian sites included (the criteria for inclusion are discussed below) and some modern cities to help situate these. Figure 13.2 shows the location of the Aurignacian sites included.

This region is key to the evaluation and discussion of the Middle to Upper Palaeolithic transition for a number of reasons: (1) In being located along the Mediterranean littoral, in a region of passage between Italy and Spain, Mediterranean France is located right along one of the routes hypothesised by some as having been taken by *Homo sapiens* in their migration across Europe (Kozłowski 1992; Mellars 2004). Thus, it is a key region for the investigation of a possible interaction between early members of our species and Neanderthals. This latter depends, of course, on the species attribution of a given industry, attributions which have, especially within the last few years, received renewed debate. In light of some new Holocene radiocarbon dates on *Homo sapiens* remains thought to have been associated with the Early Upper Palaeolithic and the extreme paucity of diagnostic anthropological remains directly associated securely with Aurignacian cultural remains, particularly the early Aurignacian (Gambier 1993; Smith *et al.* 1999; Churchill and Smith 2000; Trinkaus *et al.* 2003; Conard *et al.* 2004; Mellars 2004; Wild *et al.* 2005), the direct association between culture and species in this period is particularly tenuous based on currently available data. (2) Also, in being specifically located on the Mediterranean littoral, the region of Mediterranean France is by definition very close to a large source of shells and thus this region has the potential of being a shell-ornament production centre, an artefact-type of importance in any assessment of the Middle to Upper Palaeolithic transition. (3) Being part of southern Europe, it also benefits from good climate relative to more northerly and continental regions and thus likely witnessed continuous occupation, both in the Middle and Early Upper Palaeolithic periods. (4) As well, in being situated so geographically close to the Perigord, the Pyrenean region and the Iberian peninsula, for which the transition is much better known and researched, Mediterranean France provides us with a good testing ground for evaluating to what extent the transition may have been similar or different within a restricted geographical area, that of southern western Europe.


France
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25 0 25 50 75
Kilometres

Figure 13.1 Map of Mousterian sites in Mediterranean France (see text for site inclusion criteria) 1. Pié-Lombard, 2. Bérigoule, 3. Trécassats, 4. Pied de Sault, 5. Aubésier, 6. Peyrards, 7. Bas-Guillotte, 8. Sablons, 9. Coquillade, 10. Combette, 11. Bonne, 12. Breuil, 13. Sainte-Maxime, 14. Murée, 15. Plaine de Sirène, 16. Sauzade, 17. Adaouste, 18. Barral, 19. Rainaude I, 20. Trémie, 21. Saint-Loup, 22. Les Michelles, 23. Tonneau, 24. Gardure, 25. Station des Peyrards, 26. Ségriès, 27. Colle Rousse, 28. Rigabe, 29. Payre, 30. Oullins, 31. Saint-Marcel, 32. Serre Pluma, 33. Ranc Pointu 2, 34. Maras, 35. Baou-de-la-Sello, 36. Figuier, 37. Balazuc, 38. Pêcheurs, 39. Flandin, 40. Moula, 41. Néron, 42. Mandrin, 43. Ranc de l'Arc, 44. Haut Gabernard, 45. Bois du Tallon, 46. Fontarèches, 47. Les Pradas, 48. Cros de Peyrolles, 49. Ioton, 50. Balauzière, 51. St Vérédème, 52. Les Charlots, 53. Calmette, 54. Esquicho-Grapaou, 55. Bézal de Souvignargues, 56. Mas d'Espanet, 57. Verrerie de Macassargues, 58. Bourgade, 59. Cayla, 60. Hortus, 61. Baumasse d'Antonègue, 62. Salpêtre de Pompignan, 63. Roquette II, 64. Brugas, 65. Foissaguet, 66. Rouziganet, 67. Ramandils, 68. Crouzade, 69. Poteries, 70. St-Paul-et-Valmalle 2, 71. Vallat des Marchands, 72. Jean Thomas I, 73. Rothschild, 74. Cadenas, 75. Cennes Monestiés, 76. Ermitage, 77. Mitg, 78. Belvis, 79. Tournal (Basemap © Bartholomew Ltd. 2008 Reproduced by Kind Permission of HarperCollins Publishers www.bartholomewmaps.com)

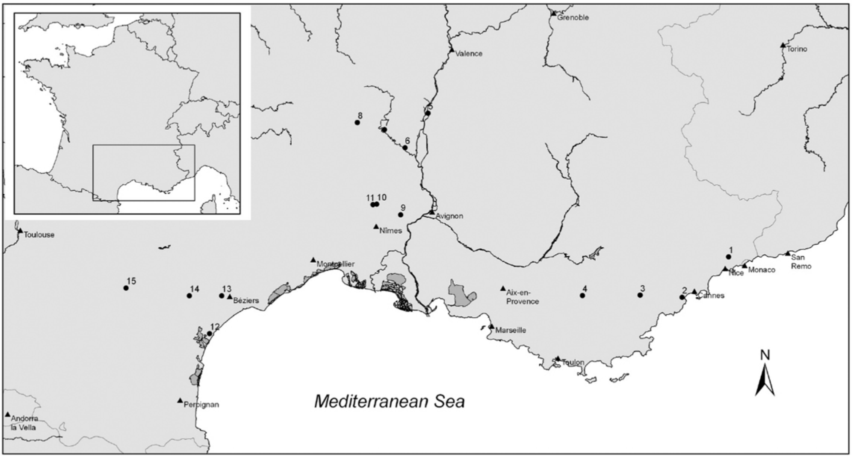


Figure 13.2 Map of Aurignacian sites in Mediterranean France (see text for site inclusion criteria). 1. Périgaud, 2. Barral, 3. Blavet, 4. Rainaude-I, 5. Mandrin, 6. Figuier, 7. Chauvet, 8. Pêcheurs, 9. Salpêtrière, 10. Laouza, 11. Esquicho-Grapaou, 12. Crouzade, 13. Régismont-le-Haut, 14. Tournal, 15. Canecaude. (Basemap: ESRI Data & Maps 2004)

The purpose of this paper to examine in what ways and to what extent, if at all, the patterns of behaviour changed over the critical Middle to Upper Palaeolithic transition within Mediterranean France. In particular, this paper will focus on examining whether, and the extent to which, some of the most striking changes that have been noted as having taken place in other regions over this transition, notably, use of bone, antler and ivory, production of shell and non-shell ornaments, presence of decorative artefacts and parietal art, occurred over this period in Mediterranean France. These artefacts are often present in large numbers in the sites in Southwestern and Pyrenean France (Vézian and Vézian 1966, 108–119; Knecht 1993; Taborin 1993; White 1993, 1995; Bon 2002, 75; Liolios 2006; Vanhaeren and d'Errico 2006), Belgium (Lejeune 1987; Knecht 1993), Germany (Hahn 1972, 1993; Conard 2003; Conard and Bolus 2003, 2006) and Italy (Broglio 1996; Kuhn and Stiner 1998; Stiner 1999; Mussi 2001, 205–206; Broglio and Dalmeri 2005; Broglio *et al.* 2006).

This paper will focus on what the Aurignacian of Mediterranean France shows us in terms of these proposed changes, *i.e.*, does the Aurignacian of Mediterranean France clearly indicate a substantial use of new, non-lithic raw materials, ornaments and decoration as do some of its neighbours ? If so, what does this imply and is it necessarily a substantial change from the Mousterian that preceded it ? If not, why not: is it really a behavioural difference with other regions where change has been noted or is it potentially a product of taphonomic and/or excavation factors such as, artefact recovery, faunal preservation or excavation area? Although other traits have been noted as characteristic of the transition, notably changes in lithic typology, technology, degree of faunal specialisation and extent of long-distance raw material transport (for overviews, see Mellars 1989, 2004; Bar-Yosef 2002; Chazan 2003), they will not be dealt with here. They are being considered, however, as part of a larger comparison by the author of these periods in this region.

Criteria for assemblage inclusion

The Mousterian sites in Mediterranean France to which the Aurignacian sites will be compared are those listed in Szmidt (2003, 1,3–4, and Appendix A, 257–267), which includes an explanation of the assemblage adoption criteria used. In total, 79 Mousterian sites (194 assemblages), spanning oxygen isotope stage (OIS) 5d to 3, are used for the comparison. The location of these Mousterian sites is shown on Figure 13.1.

Whereas in some cases it would be most appropriate, when examining the Middle to Upper Palaeolithic transition, to compare the two periods at the same time interval, in particular the period around 40 000–30 000 BP, the appropriate unit of comparison depends, in fact, on the research questions being asked. This paper deliberately takes a larger temporal perspective, for two principal reasons. First of all, identifying correctly which are late Mousterian assemblages is fraught with the difficulty of lack of chronometric dates for the vast majority of sites and relies instead on typological criteria (which is circular) (see Szmidt 2003, Chapter 9, for a detailed discussion of chronology for the Mousterian in Mediterranean France). Secondly, the research question of interest here is whether Neanderthals *ever* participated in the behaviours usually ascribed to the Aurignacian (and indirectly to modern humans). If it is found that they did, then the critical follow-up question would be to find out if this occurred before the arrival of modern humans or concurrently with their presence, through dating of the sites in question, for instance.

Regarding the Early Upper Palaeolithic, the Châtelperronian does not exist in Mediterranean France (Bazile 1979, 11; Onoratini 1982, 197; Onoratini 1984–1985, 33; Combier 1990). The site of Belvis was initially thought to be Châtelperronian (Sacchi 1986; Sacchi *et al.* 1993), but this small assemblage has been re-classified as Mousterian since then (Maroto *et al.* 2001–2002). The Early Upper Palaeolithic is thus characterised by two main types of industries in Mediterranean France. One industry is variously labelled as: Protoaurignacian, Aurignacian 0, Primitive Aurignacian, Initial Aurignacian, Archaic Aurignacian and, recently (Bazile and Sicard 1999, 123), ‘Mochien méditerranéen’. Another industry is variously labelled as: Typical Aurignacian, Aurignacian I, Classic Aurignacian, Ancient Aurignacian. The technological and typological differences between these two main industries as they pertain to Mediterranean France have been very thoroughly described and discussed elsewhere (Bazile and Sicard 1999; Bazile 2002, 2005; Bon 2002, 2006; Slimak *et al.* 2002, 2006; Onoratini 2004b). The designation ‘Ancient Aurignacian’ by researchers in the past is often broadly equivalent, however, to the ‘Archaic Aurignacian’ of today’s terminology. In a few cases, only the broad label ‘Aurignacian’ is used to characterise an assemblage in Mediterranean France usually due to the fact that the assemblage is too small to identify it more specifically and/or because it was analysed before these more recent divisions of Aurignacian technology were made.

The Protoaurignacian/Archaic Aurignacian is possibly older than the Typical/Ancient Aurignacian in this region given that in the few instances where both are found in the same sequence (three sites in Mediterranean France), the former is stratified below the latter (Lhomme 1976, 6; Tavoso 1987; Bazile and Sicard 1999, Figure 2, 119). This does not exclude, however, the possibility of chronological overlap of these industries. In fact, the timing of the beginning of the Aurignacian in this region, the exact chronological relationship between its industries (duration, possible extent of overlap) and the chronological relationship to the Aurignacian of neighbouring regions, are not yet clear, but are currently the subject of a multi-site chronometric dating project directed by the author, done in collaboration with colleagues (*e.g.*, Bon *et al.* 2007; Bordes *et al.* in press). This research is outside the scope of the present article and thus will not be discussed here.

All assemblages attributed to the Aurignacian *sensu lato* are included here aside from the following. Assemblages where the attribution was labelled, in the literature, as tentatively Aurignacian because the assemblage was very small and/or because it was clearly mixed with other industries, were completely excluded from the analyses. These are the assemblages of Cabre, Esclans Merle, Pardigon, Pennafort, Sainte-Anne d'Evenos, in Provence, and Nicolas, Oullins, Balmo-Pretchadouïro-Basse, Cauneilles-Basses, Gazel and Traouc de la Fado in Languedoc-Roussillon (Combier 1967; Barbaza 1979; Bazile *et al.* 1982; Onoratini 1982; Sacchi 1986, 1994b; Onoratini and Raux 1992). The site of Aldène, whose parietal art may date to the Aurignacian (Ambert *et al.* 2005), but whose recently obtained radiometric dates (*Ibid.*) could also place the art in the Gravettian, was also excluded for now. These excluded assemblages serve to indicate, however, that the Aurignacian presence in Mediterranean France was likely more extensive than the larger and more reliably attributed assemblages included here indicate.

The results of the current excavation at Régismont-le-Haut, under the direction of François Bon and co-direction of Romain Mensan, are not included in this analysis because it is research in progress. Suffice it to say that these excavations have unearthed more shells (Bon *et al.* 2007) and that these, as well as the rest of the analyses at this site (where sieving, large area of excavation and taphonomic evaluation are all being done) will certainly substantially increase our knowledge and understanding of the Aurignacian of Mediterranean France. For now, only the results of the older excavation at this site are included.

Also excluded from this analysis are sites where it was clearly stated that the Aurignacian assemblage was mixed with later Upper Palaeolithic material (either because it was found that way or because of lack of stratigraphic understanding or control when it was excavated). Given that the types of artefacts being considered in this analysis are known to exist in the later Palaeolithic, such mixed sites do not allow us reliably to address the main question posed, namely, "Do these artefacts exist, and in what quantity, in the *Aurignacian*, specifically ?". The assemblages excluded on these grounds are l'Aille, Lieutenante, Balauzière and Rothschild, as these assemblages are mentioned as being mixed with Gravettian and/or Magdalenian material (Ravoux 1966, 42; Bazile 1977, 154–155, Bazile 1999, 61; Onoratini and Raux 1992, 74, 76; Ambert 1994, 23). The latter two sites do contain the artefact types considered here (Ravoux 1966; Barge 1983; Ambert 1994; Bazile 1999, 62), and it is possible that some, or even many, of these artefacts do, in fact, relate to the Aurignacian part of the occupation. As there is a strong possibility that some, or even most, of the cultural attribution of the material in these four sites is not Aurignacian, though, they have been excluded to avoid the potential of obtaining spurious results. In addition, the material from

Salle 3 of the Huchard *et al.* excavation at Figuier is stated as being mixed with the Quina Mousterian (Combier 1967, 226). Thus, the two shaped bone/antler artefacts from this part of the site (Combier 1967, 230 and Figure 109 numbers 3 and 6, 231) cannot be included in this analysis as the cultural attribution (Mousterian or Aurignacian) cannot be established in this case.

More detailed mention should be made of the site of Rothschild as its unusually large collection of perforated shells and other ornaments deserves further explanation if it is to be excluded. Most of the deposits at this site were 'excavated' from 1899 by numerous people who hardly published their findings and who left the site in a devastating state. In these various excavations, Mousterian, Aurignacian, Magdalenian and Neolithic artefacts were recovered (Barge 1983; Ambert 1994, 23–24)

A phenomenal number and variety of shells (the vast majority perforated) were found from the various interventions on the site that had taken place over nearly a century. Combining them all, the total number listed by Barge (1983), who analysed them, is over 400, representing over 20 species. Tooth and stone pendants were also found (Barge 1983, 80, 82).

Barge (1983) identifies the Rothschild ornaments as belonging to the Aurignacian, based on the fact that many of the species of shells represented are found in other western European Aurignacian sites. Most of these species are also found in the Magdalenian, however, as Barge (1983, 78, 79 Table 1D), in fact, points out. As well, some of the Mediterranean France sites to which she compared Rothschild in 1983 when she published her study are now known not to be Aurignacian, and/or the layers in which are found their shells are not Aurignacian.

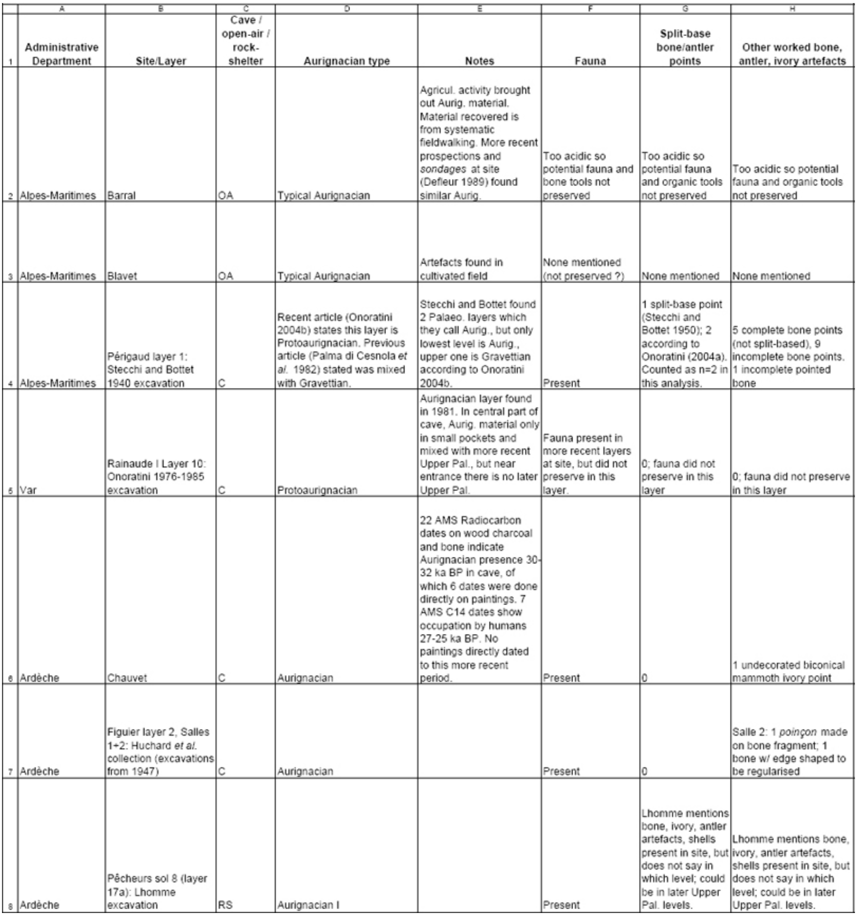
Although it is very likely that at least some of these ornaments were made during Aurignacian times, the presence of more recent periods at the site, combined with the lack of stratigraphic control/provenience make it impossible to know which, if any, of the ornaments belong to the Aurignacian occupation. Whether any might perhaps be Mousterian is, of course, also unknown given the collection and stratigraphic circumstances. For these reasons, Rothschild was excluded entirely from this analysis.

Thus, for the Aurignacian, a total of 23 assemblages, representing 15 sites, are included in this analysis (see Figure 13.2 and Table 13.1), with the references to the raw data used per site being listed in Column N of Table 13.1. For the analysis, two of the layers of the site of Esquicho-Grapaou (layers SLC1a and SLC1b of F. Bazile's excavation) were grouped, as often the artefacts from these two sub-layers are labelled in the literature as coming from SLC1 without specifying the sub-layer. Also, for the site of Salpêtrière, only layer CG5 (and its equivalent other labels) was included in this analysis. Other layers of the site, which had previously been attributed to the Aurignacian, are no longer considered Aurignacian (Bazile 1996, 1999, 75–76).

Many of the Aurignacian sites included were excavated by a number of teams over the years. Column B of Table 13.1 lists which specific excavations the Aurignacian data included in this analysis refer to. Columns G to J list the number of split-base bone/antler points, other worked bone/antler/ivory artefacts, ornaments and decorated artefacts/art, respectively, with comments. Each assemblage takes one row of the table, across two facing pages.

When it was clearly stated in the literature that a particular artefact type was absent from an assemblage, a value of 0 was recorded in the relevant cell of Table 13.1. On the other hand, in cases where no information about a particular artefact type was ever mentioned, this was indicated in the relevant part of Table 13.1 by the comment ‘not mentioned in literature’ or ‘none mentioned’, to distinguish it from a known absence of the artefact. This was done to keep the original data as intact as possible, but in the making of graphs, both of these were treated as having a value of zero. It is probably fair to assume that if artefacts such as ornaments, shaped bone and decorated artefacts had been found they would have been mentioned, so that equating these with a value of zero likely accurately reflects what was found during excavation.

Table 13.1 Aurignacian assemblages in Mediterranean France being considered in this analysis, detailing information regarding the artefact types under consideration in this analysis. Data for these assemblages continue on facing page. Data for further asemblages are on subsequent pages.



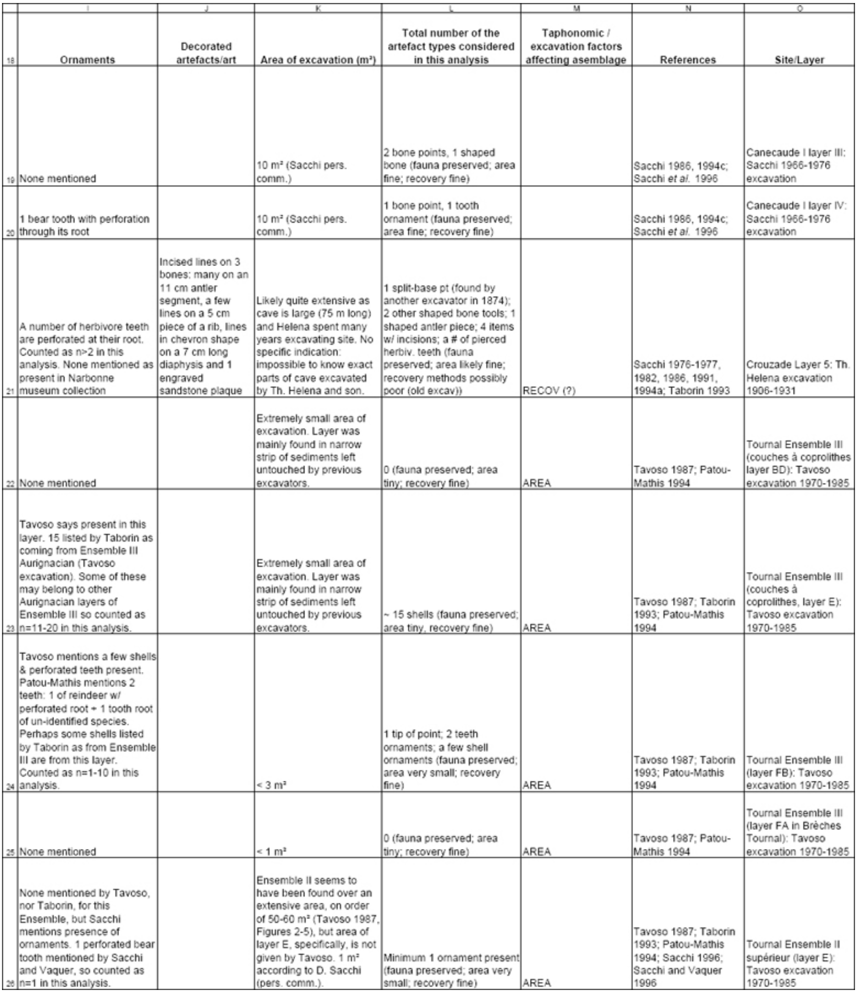
	A	B	C	D	E	F	G	H
1	**Administrative Department**	**Site/Layer**	**Cave / open-air / rock-shelter**	**Aurignacian type**	**Notes**	**Fauna**	**Split-base bone/antler points**	**Other worked bone, antler, ivory artefacts**
2	Alpes-Maritimes	Barral	OA	Typical Aurignacian	Agricul. activity brought out Aurig. material. Material recovered is from systematic fieldwalking. More recent prospections and *sondages* at site (Defleur 1989) found similar Aurig.	Too acidic so potential fauna and bone tools not preserved	Too acidic so potential fauna and organic tools not preserved	Too acidic so potential fauna and organic tools not preserved
3	Alpes-Maritimes	Blavet	OA	Typical Aurignacian	Artefacts found in cultivated field	None mentioned (not preserved ?)	None mentioned	None mentioned
4	Alpes-Maritimes	Périgaud layer 1: Stecchi and Bottet 1940 excavation	C	Recent article (Onoratini 2004b) states this layer is Protoaurignacian. Previous article (Palma di Cesnola *et al.* 1982) stated was mixed with Gravettian.	Stecchi and Bottet found 2 Palaeo. layers which they call Aurig., but only lowest level is Aurig., upper one is Gravettian according to Onoratini 2004b.	Present	1 split-base point (Stecchi and Bottet 1950); 2 according to Onoratini (2004a). Counted as n=2 in this analysis.	5 complete bone points (not split-based), 9 incomplete bone points. 1 incomplete pointed bone
5	Var	Rainaude I Layer 10: Onoratini 1976-1985 excavation	C	Protoaurignacian	Aurignacian layer found in 1981. In central part of cave, Aurig. material only in small pockets and mixed with more recent Upper Pal., but near entrance there is no later Upper Pal.	Fauna present in more recent layers at site, but did not preserve in this layer.	0; fauna did not preserve in this layer	0; fauna did not preserve in this layer
6	Ardèche	Chauvet	C	Aurignacian	22 AMS Radiocarbon dates on wood charcoal and bone indicate Aurignacian presence 30-32 ka BP in cave, of which 6 dates were done directly on paintings. 7 AMS C14 dates show occupation by humans 27-25 ka BP. No paintings directly dated to this more recent period.	Present	0	1 undecorated biconical mammoth ivory point
7	Ardèche	Figuier layer 2, Salles 1+2: Huchard *et al.* collection (excavations from 1947)	C	Aurignacian		Present	0	Salle 2: 1 *poinçon* made on bone fragment; 1 bone w/ edge shaped to be regularised
8	Ardèche	Pêcheurs sol 8 (layer 17a): Lhomme excavation	RS	Aurignacian I		Present	Lhomme mentions bone, ivory, antler artefacts, shells present in site, but does not say in which level; could be in later Upper Pal. levels.	Lhomme mentions bone, ivory, antler artefacts, shells present in site, but does not say in which level; could be in later Upper Pal. levels.

	I	J	K	L	M	N	O
1	**Ornaments**	**Decorated artefacts/art**	**Area of excavation (m²) of Aurignacian**	**Total number of the artefact types considered in this analysis**	**Taphonomic / excavation factors affecting asemblage**	**References**	**Site/Layer**
2	None mentioned. Agricul. activity brought out Aurig. material. Lack of ornaments possibly related to these conditions, but did do systematic recovery. More recent prospections and *sondages* at site (Defleur 1989), however, found similar Aurig.		Quite large area	0 (fauna not preserved; area fine; agricul. so maybe small artefacts got broken, but systematic recovery done)	FAUNA	Onoratini *et al.* 1981; Onoratini 1982, 1984, 1984-1985, 2004a; Defleur 1989; Onoratini and Raux 1992	Barral
3	None mentioned		Not specified	0 (OA so fauna prob. not preserved; area unknown; agricul. field so maybe small artefacts got broken; found recently so recovery from that very likely fine.)	FAUNA (?); AREA (?); RECOV (?)	Onoratini and Raux 1992	Blavet
4	0 shells listed by Stecchi and Bottet in layer 1. Taborin lists 4 for Aurign-Gravett. Shells attributed to Gravettian and Neolithic by Onoratini and Raux. Thus counted as 0 for this analysis.		Not specified	16 bone points incl. 1 split-base. (fauna fine; area unspecified; recovery methods possibly poor (old excav.), although did find small artefacts)	AREA (?); RECOV (?)	Stecchi and Bottet 1950; Onoratini 1982, 2004a, b; Palma di Cesnola *et al.* 1982; Onoratini and Raux 1992; Taborin 1993	Périgaud layer 1: Stecchi and Bottet 1940 excavation
5	None mentioned by Onoratini. None mentioned for this layer by Taborin but present in more recent layers.		Estimating from text of publications, seems to be 3 m² unmixed in one sector and, in another sector, a few more m² mixed with later material	0 (fauna did not preserve; area small; recovery fine)	FAUNA; AREA	Onoratini 1982, 1984, 1984-1985, 1986, 2004b; Onoratini and Raux 1992; Taborin 1993	Rainaude I Layer 10: Onoratini 1976-1985 excavation
6	None mentioned	6 animals are dated by AMS radiocarbon to Aurignacian 30-32 ka BP. More may be Aurignacian but not dated directly.	Thousands of m²	1 ivory point, min. 6 animals parietal art (fauna preserved; area fine, recovery fine)		Clottes 2001; Philippe and Fosse 2003	Chauvet
7	Salle 2: Flat limestone *galet* with hole through its centre. No ornaments mentioned by Taborin from Aurignacian of Huchard excavation		Estimating from figures and text of publications, the part of the cave linking Salles 1 and 2 is on the order of 12 m² + Aurignacian extends into the entrance of Salle 2.	2 shaped bones, 1 limestone 'ornament' (fauna preserved; area fine; recovery methods possibly poor (old excav)).	RECOV (?)	Combier 1967; Debard 1988; Taborin 1993	Figuier layer 2, Salles 1+2: Huchard *et al.* collection (excavations from 1947)
8	Shells present in later Upper Pal. levels according to Lhomme; none listed for Aurig. by Taborin		Between 18 and 25 m²	Probably 0: mentions bone, ivory, antler artefacts and shells present in site, but does not say in which level: could be in later Upper Palaeolithic levels. Likely 0 shells (fauna preserved; area fine; recovery likely fine)		Lhomme 1976, 1983, 1984, 1987; Debard 1988; Onoratini and Combier 1991; Taborin 1993; Masaoudi *et al.* 1994	Pêcheurs sol 8 (layer 17a): Lhomme excavation

	A	B	C	D	E	F	G	H
9	**Administrative Department**	**Site/Layer**	**Cave / open-air / rock-shelter**	**Aurignacian type**	**Notes**	**Fauna**	**Split-base bone/antler points**	**Other worked bone, antler, ivory artefacts**
10	Ardèche	Pêcheurs sol 9 (layer 18a): Lhomme excavation	RS	Aurignacian I		Present	1 split-base point	Lhomme mentions bone, ivory, antler artefacts, shells present in site, but does not say in which level; could be in later Upper Pal. levels.
11	Ardèche	Pêcheurs sol 10 (layer 19a): Lhomme excavation	RS	Aurignacian 0		Present	Lhomme mentions bone, ivory, antler artefacts, shells present in site, but does not say in which level; could be in later Upper Pal. levels.	Lhomme mentions bone, ivory, antler artefacts, shells present in site, but does not say in which level; could be in later Upper Pal. levels.
12	Drôme	Mandrin Level 1: Giraud excavation	C	Protoaurignacian	Layer mixed to some extent with Mousterian and Bronze Age	Present	None mentioned	None mentioned
13	Gard	Esquicho-Grapaou level BR1: Bazile excavation	C	Classic Aurignacian		Not mentioned in this layer. Present in other Aurignacian layers at site.	None mentioned	None mentioned
14	Gard	Esquicho-Grapaou level SLC1a+b: Bazile excavation	C	Protoaurignacian/Primitive Aurignacian/Initial Aurignacian		Present	None mentioned	1 bone *sagaie* w/ oval cross-section: groove along half of its longit. axis, base broken prob. not split, but maybe thinned; 2 *poinçons*.
15	Gard	Laouza level 2b 1: Bazile 1973-4 rescue excavation, including screening of backdirt of previous Bayol excavation and his study of Bayol museum collection material	RS	Protoaurignacian/Primitive Aurignacian/Initial Aurignacian	Dug in 1931 by Bayol and then Bazile in 1973 and 1974. Bazile excavated intact deposits and screened all backdirt of Bayol's excavation.	Present	None mentioned	Possibly 2 sections of small *sagaies* in bone. Counted as n=2 in this analysis.
16	Gard	Salpêtrière: Bazile excavation (1974-81) layer CG5=SLC4 + equivalent E. de Fonton layer 32C material	C	Ancient Aurignacian	Site was excav. by many, most of whom mixed layers of differing cultr. (Aurig. w/ Solutr. & Magda.), so not reliable chronol attribution of artefacts. Thus, only excav. material of Bazile + de Fonton is included here.	Present	None mentioned	1 frag of *poinçon* / small point of oval cross-section Bazile excav.; 1 *bâton percé* of antler de Fonton excav. A fragment of another *bâton percé* was found in Nîmes museum from Bayol's excav. at site, but this fragment was not counted in this analysis.
17	Hérault	Régismont-le-Haut: Maurin 1961-62 excavation	OA	Ancient Aurignacian	Explicitly stated that the sediments were screened during excavation	Virtually no fauna preserved: around 30 bones found on 65 m² area of excavation	Virtually no fauna preserved (around 30 bones found), thus potential bone tools could not preserve	Virtually no fauna preserved (around 30 bones found), thus potential bone tools could not preserve

	I	J	K	L	M	N	O
9	**Ornaments**	**Decorated artefacts/art**	**Area of excavation (m^2) of Aurignacian**	**Total number of the artefact types considered in this analysis**	**Taphonomic / excavation factors affecting asemblage**	**References**	**Site/Layer**
10	Shells present in later Upper Pal. levels according to Lhomme; none listed for Aurig. by Taborin		Between 18 and 25 m^2	1 split base pt; mentions bone, ivory, antler artefacts and shells present in site, but does not say in which levels: could be from later Upper Palaeolithic levels. Likely 0 shells (fauna preserved; area fine; recovery likely fine)		Lhomme 1976, 1983, 1984, 1987; Debard 1988; Onoratini and Combier 1991; Taborin 1993; Masaoudi *et al.* 1994	Pêcheurs sol 9 (layer 18a): Lhomme excavation
11	Shells present in later Upper Pal. levels according to Lhomme; none listed for Aurig. by Taborin		Between 18 and 25 m^2	Probably 0: mentions bone, ivory, antler artefacts and shells present in site, but does not say in which levels: could be from later Upper Palaeolithic levels. Likely 0 shells (fauna preserved, area fine, recovery likely fine)		Lhomme 1976, 1983, 1984, 1987; Debard 1988; Onoratini and Combier 1991; Taborin 1993; Masaoudi *et al.* 1994	Pêcheurs sol 10 (layer 19a): Lhomme excavation
12	None mentioned		29 m^2	0 (fauna preserved; area fine; recovery fine)		Giraud *et al.* 1998; Slimak *et al.* 2002, 2006	Mandrin Level 1: Giraud excavation
13	None mentioned		Estimating from figures and text of publications, 1-2 m^2 in Galerie B properly stratified & maybe 2 m^2 more in zone where material likely pulled down because of water circulation (*soutirage*)	0 (fauna preserved at site but not mentioned in this layer; area small; recovery fine)	AREA; FAUNA (?)	Roudil 1976; Bazile 1977, 1979; Bazile *et al.* 1981; Brugal 1981	Esquicho-Grapaou level BR1: Bazile excavation
14	1 limestone pendant with broken hole for suspension. In some publications it is referred to as a bone pendant.		SLC 1a+b > 9 m^2	In SLC 1 a + b found: 3 worked bones; 1 pendant (fauna preserved; SLC 1a+b area fine; recovery fine)		Roudil 1976; Bazile 1977, 1979, 1999, 2002; Bazile *et al.* 1981; Brugal 1981; Sicard 1994; Bazile and Sicard 1999	Esquicho-Grapaou level SLC1a+b: Bazile excavation
15	19 shells: 6 types. Specific # perforated not provided, but it is mentioned that a number of them are perforated. Most found *in situ* , but some in backdirt of Bayol excavations.		Cannot determine as most material is from screening of previous excavations of Bayol, but likely large area as this was common practice.	19 shells; possibly 2 shaped bones (fauna preserved, but badly; area likely fine if include area backdirt came from; Bazile recovery fine+ screened backdirt of previous excav.)		Bazile 1977, 1979, 1999, 2002; Bazile *et al.* 1981; Brugal 1981; Barge 1983; Taborin 1993; Sicard 1995; Bazile and Sicard 1999	Laouza level 2b 1: Bazile 1973-4 rescue excavation, including screening of backdirt of previous Bayol excavation and his study of Bayol museum collection material
16	None mentioned except in older collections where Aurig. is mixed with later industry. Taborin mentions shells, but refers to older collections as well, so data not incl. here because Aurig. attribution very uncertain.		Estimating from figures and text of publications, Aurig. of Bazile's excav. covered min 6 m^2. Extent of 32C of de Fonton excavation unknown. It is a very large cave (1300 m^2).	1 shaped bone; 1 shaped antler (fauna preserved; de Fonton area unknown, but added to Bazile's, likely fine; de Fonton recovery unknown, but Bazile's fine)	AREA (?); RECOV (?)	Ravoux 1966; Bazile 1977, 1979, 1996, 1999; Brugal 1981; Taborin 1993	Salpêtrière: Bazile excavation (1974-81) layer CG5=SLC4 + equivalent E. de Fonton layer 32C material
17	Shells present: 14 complete + 23 frag. of shells (min 9 perforated).		65 m^2	Max. 37 shells (fauna hardly preserved; area fine; recovery fine)	FAUNA	Maurin and Ambert 1979; Barge 1983; Ambert 1994; Bon 2002	Régismont-le-Haut: Maurin 1961-62 excavation

	A	B	C	D	E	F	G	H
18	**Administrative Department**	**Site/Layer**	**Cave / open-air / rock-shelter**	**Aurignacian type**	**Notes**	**Fauna**	**Split-base bone/antler points**	**Other worked bone, antler, ivory artefacts**
19	Aude	Canecaude I layer III: Sacchi 1966-1976 excavation	C	Typical Aurignacian		Present	0	2 small bone points (*sagaies*) of round cross-section, one biconical, one more tapered (both broken on both their ends). 1 small piece of a *baguette* of square cross-section
20	Aude	Canecaude I layer IV: Sacchi 1966-1976 excavation	C	Typical Aurignacian		Present	0	1 small bone point (*sagaie*) of oval cross-section
21	Aude	Crouzade Layer 5: Th. Helena excavation 1906-1931	C	Ancient Aurignacian	Layer 5 of Th. Helena = layer F which is layer 10 in Sacchi nomenclature. It is covered by sterile deposits.	Present	0 split-base points mentioned by Helena and/or in his collection, but 1 was found from 1874 Rousseau excavation: specific provenience unknown.	Sacchi identified 1 polygon cross-section piece of a *sagaie*, a fragment of a possible compressor and a small antler notched piece.
22	Aude	Tournal Ensemble III (couches à coprolithes layer BD): Tavoso excavation 1970-1985	C	Aurignacian (type cannot be specified because assemblage small)	This layer may be the equivalent of Ensemble III layer FB, but association difficult to make. This layer BD is what Patou-Mathis refers to as F4	Present	None mentioned	None mentioned
23	Aude	Tournal Ensemble III (couches à coprolithes, layer E): Tavoso excavation 1970-1985	C	Aurignacian (type cannot be specified because assemblage small). Possibly Ancient Aurignacian, according to Tavoso, based on presence of Dufour bladelet in this layer (which is equivalent to Archaic Aurignacian in current terminology).	This layer is what Patou-Mathis refers to as F3. This layer may be the equivalent of Ensemble III layer FA of Brèches Tournal and of layer E of Ensemble II supérieur	Present	None mentioned	None mentioned
24	Aude	Tournal Ensemble III (layer FB): Tavoso excavation 1970-1985	C	Typical Aurignacian		Present	None mentioned	None mentioned by Tavoso; Patou-Mathis (1994) states that the tip of a point was found in this layer. Counted as n=1 in this analysis.
25	Aude	Tournal Ensemble III (layer FA in Brèches Tournal): Tavoso excavation 1970-1985	C	Ancient Aurignacian according to Tavoso (which is equivalent to Archaic Aurignacian in current terminology).		Present	None mentioned	None mentioned
26	Aude	Tournal Ensemble II supérieur (layer E): Tavoso excavation 1970-1985	C	Ancient Aurignacian according to Tavoso (which is equivalent to Archaic Aurignacian in current terminology). Initial Aurignacian according to Sacchi.	This layer E from Ensemble II supérieur is not to be confused with layer E (Mousterian) from Ensemble III.	Present	None mentioned	None mentioned



	I	J	K	L	M	N	O
18	Ornaments	Decorated artefacts/art	Area of excavation (m^2)	Total number of the artefact types considered in this analysis	Taphonomic / excavation factors affecting asemblage	References	Site/Layer
19	None mentioned		10 m^2 (Sacchi pers. comm.)	2 bone points, 1 shaped bone (fauna preserved; area fine; recovery fine)		Sacchi 1986, 1994c; Sacchi *et al.* 1996	Canecaude I layer III: Sacchi 1966-1976 excavation
20	1 bear tooth with perforation through its root		10 m^2 (Sacchi pers. comm.)	1 bone point, 1 tooth ornament (fauna preserved; area fine; recovery fine)		Sacchi 1986, 1994c; Sacchi *et al.* 1996	Canecaude I layer IV: Sacchi 1966-1976 excavation
21	A number of herbivore teeth are perforated at their root. Counted as n>2 in this analysis. None mentioned as present in Narbonne museum collection	Incised lines on 3 bones: many on an 11 cm antler segment, a few lines on a 5 cm piece of a rib, lines in chevron shape on a 7 cm long diaphysis and 1 engraved sandstone plaque	Likely quite extensive as cave is large (75 m long) and Helena spent many years excavating site. No specific indication: impossible to know exact parts of cave excavated by Th. Helena and son.	1 split-base pt (found by another excavator in 1874); 2 other shaped bone tools; 1 shaped antler piece; 4 items w/ incisions; a # of pierced herbiv. teeth (fauna preserved; area likely fine; recovery methods possibly poor (old excav))	RECOV (?)	Sacchi 1976-1977, 1982, 1986, 1991, 1994a; Taborin 1993	Crouzade Layer 5: Th. Helena excavation 1906-1931
22	None mentioned		Extremely small area of excavation. Layer was mainly found in narrow strip of sediments left untouched by previous excavators.	0 (fauna preserved; area tiny; recovery fine)	AREA	Tavoso 1987; Patou-Mathis 1994	Tournal Ensemble III (couches à coprolithes layer BD): Tavoso excavation 1970-1985
23	Tavoso says present in this layer. 15 listed by Taborin as coming from Ensemble III Aurignacian (Tavoso excavation). Some of these may belong to other Aurignacian layers of Ensemble III so counted as n=11-20 in this analysis.		Extremely small area of excavation. Layer was mainly found in narrow strip of sediments left untouched by previous excavators.	~ 15 shells (fauna preserved; area tiny, recovery fine)	AREA	Tavoso 1987; Taborin 1993; Patou-Mathis 1994	Tournal Ensemble III (couches à coprolithes, layer E): Tavoso excavation 1970-1985
24	Tavoso mentions a few shells & perforated teeth present. Patou-Mathis mentions 2 teeth: 1 of reindeer w/ perforated root + 1 tooth root of un-identified species. Perhaps some shells listed by Taborin as from Ensemble III are from this layer. Counted as n=1-10 in this analysis.		< 3 m^2	1 tip of point; 2 teeth ornaments; a few shell ornaments (fauna preserved; area very small; recovery fine)	AREA	Tavoso 1987; Taborin 1993; Patou-Mathis 1994	Tournal Ensemble III (layer FB): Tavoso excavation 1970-1985
25	None mentioned		< 1 m^2	0 (fauna preserved; area tiny; recovery fine)	AREA	Tavoso 1987; Patou-Mathis 1994	Tournal Ensemble III (layer FA in Brèches Tournal): Tavoso excavation 1970-1985
26	None mentioned by Tavoso, nor Taborin, for this Ensemble, but Sacchi mentions presence of ornaments. 1 perforated bear tooth mentioned by Sacchi and Vaquer, so counted as n=1 in this analysis.		Ensemble II seems to have been found over an extensive area, on order of 50-60 m^2 (Tavoso 1987, Figures 2-5), but area of layer E, specifically, is not given by Tavoso. 1 m^2 according to D. Sacchi (pers. comm.).	Minimum 1 ornament present (fauna preserved; area very small; recovery fine)	AREA	Tavoso 1987; Taborin 1993; Patou-Mathis 1994; Sacchi 1996; Sacchi and Vaquer 1996	Tournal Ensemble II supérieur (layer E): Tavoso excavation 1970-1985

It is clearly possible that, in light of new technological studies, new excavations, new definitions and/or new dates, some of the assemblages included in this analysis may no longer be considered Aurignacian and that others may need to be added. For instance, recent research focused on lithic technology has revealed that certain typological characteristics (especially carinated pieces), often thought to be diagnostic of the Aurignacian, are found, in fact, also in later phases of the Upper Palaeolithic and thus that assemblages whose attribution to the Aurignacian rests exclusively on such typological grounds, may need to be re-evaluated (Le Brun-Ricalens and Brou 2003; Brou and Le Brun-Ricalens 2005; Le Brun-Ricalens 2005; Almeida 2006). Our characterisation and definition of the Aurignacian and our classification of assemblages may, in other words, be altered in time, at which point this, and all other studies of the Aurignacian sites of this region and others, will need to be revised if substantial definition changes are made. Also, although the bone and antler worked artefacts and ornaments of the sites presented here are thought to be the work of hominins, if detailed new analyses of the kind undertaken by researchers for other regions and periods (Stiner 1999, 2003; Villa and d'Errico 2001) are done and show them to be related instead to carnivore or other, non-hominin, agents and processes, the results presented here will need to be revised. This is a normal progress of knowledge in research.

For now, however, the attributions given in publications (*i.e.*, by researchers who have excavated, studied and published on these sites for decades and who have had ample experience researching the Aurignacian) will be used. Some doubt has already been expressed about the Aurignacian attribution of Chauvet cave, for instance (Zückner 1996; Clottes 2001; Pettitt and Bahn 2003; Genty *et al.* 2004, but see Valladas and Clottes 2003), one of the sites located in Mediterranean France. If future consensus shows this Aurignacian attribution to be incorrect, then the results presented here, which include Chauvet, will need to be re-evaluated.

Taphonomic/excavation factors

As mentioned above, in doing the kind of research presented here, where one is examining the presence and frequency of artefact types in order to be able to extract regional-scale patterns and draw conclusions about past behaviour, it is clear that non-behavioural factors which could potentially affect results must be taken into account *a priori* in order to avoid spurious conclusions. For this particular analysis, it was felt that three such factors, which one could name as a group, 'taphonomic/excavation factors', were of critical importance. Thus their effect on each assemblage was assessed during data collection. These factors are: quality of artefact recovery, faunal preservation and area of excavation, as explained below.

Quality of artefact recovery has to do with whether sediments were screened, an aspect which is rarely discussed outright. Instead, an assessment often had to be made based on subsequent analyses of the excavated material. Assemblages recovered prior to the 1970s were listed as 'recovery methods possibly poor' in the analysis unless stated otherwise in publications.

Faunal preservation relates to whether faunal remains preserved rather than the condition or quantity of bones. In some cases, publications clearly mention that conditions were too acidic for fauna to preserve and this is noted in Column F. In other cases, however, there is simply no mention of any fauna in any publication about the assemblage so that it is not clear whether it is a taphonomic issue or simply an omission of information or lack of study regarding the fauna at the site. In these cases, the label 'none mentioned' is listed in Column F.

Area of excavation is the total area (in square metres) from which the artefacts were recovered. Despite the importance of knowing area of excavation in any assessment of the reliability and representativeness of results of an assemblage, the overall area of excavation is extremely rarely stated outright. More specifically, the area of relevance in this analysis is the area of the Mousterian or Aurignacian layers (as opposed to to total surface area excavated), which are even more rarely available. Thus, 'area' was estimated as precisely as possible by combining site plans with descriptive statements about the surface area extent and included in column K of Table 13.1 for the Aurignacian. For some assemblages, the best that could be done was to include a qualitative statement. 'Not specified' means that no information regarding area was available such that even an estimate could not be calculated.

Table 13.2 Mousterian assemblages in Mediterranean France containing the artefact types under consideration in this analysis

Site	Nature of artefact(s)	Notes re. provenience	Reference(s)
Belvis	2 unpierced fossil *Turritella* shells (closest outcrop 10 km away)		Sacchi 1989, pers. comm; Sacchi *et al.* 1993; Taborin 1993
Esquicho-Grapaou	1 'compressor' (horse phalanx) and 2 retouched bones	Compressor found in old excavation (1920s); Retouched bones: part of site in which found it is not possible to determine stratigraphy, thus attribtution to Mousterian is not certain (Ravoux 1963, 780, 784)	Hughes and Gagnière 1933-1934; Ravoux 1963
Figuier	Level 1: 5 *retouchoirs* and 1 polished *poinçon*	From old excavations (1940s of P. and A. Huchard and Ribeyre), although these collections likely exclusively Mousterian material (Combier 1967, 192)	Combier 1967
Flandin	A few retouched bones		Hughes and Gauthier 1972
Mandrin	Level F: a few *retouchoirs* on equid/bovid bones		Giraud *et al.* 1998
Mitg	1 nodule of limonite (related to pyrite) at base of B10: aesthetic appreciation or as a lighter and 1 limestone piece of possible female shape with 2 ancient breaks which seem to have been made intentionally rather than created naturally.	A lot of artefacts found at site were from layers which were not *in situ* (Blaize 1986, 136; 1986-1987, 98), so although likely Mousterian, cultural attribution of these pieces is not certain. Limestone 'statuette' not *in situ*.	Blaize 1986; 1986-1987
Néron	Numerous *retouchoirs* on fragments of diaphyses; a few *poinçons*; a few retouched bone fragments; some pointed bones		Veyrier *et al.* 1951; Veyrier and Combier 1952
Oullins	Level 1: 1 *retouchoir*		Combier 1967
Pié-Lombard	4 retouched bones (3 straight lateral scrapers and 1 concave lateral scraper on diaphyses) and 1 completely polished/shiny diaphysis fragment		Texier 1974
Rigabe	Portion of distal diaphysis of humerus of large bovid, with traces of breakage, abrasion, scraping and sawing caused by human action. Purpose unknown but likely not simply to gain access to marrow, according to Defleur (1986, 1988).		Defleur 1986, 1988
Saint-Marcel	Levels g, h, i, j, j': 9 % of faunal assemblage are *retouchoirs* (n = ~ 100), *poinçons*, scrapers, points		Gilles 1976; Daujeard 2004; Moncel *et al.* 2004
Verrerie de Macassargues	1 bone polished on its end through use; 1 other modified bone		Hughes *et al.* 1951

Results

Mousterian

The percentage of Mediterranean France Mousterian assemblages reported as having at least one of the artefact types under consideration in this analysis is extremely small (16/194 assemblages = 8 % of Mousterian assemblages). Reported examples are listed in Table 13.2.

Most reported examples are of worked bone, although 'worked' usually means either that the bone shows traces of having been used as a compressor / '*retouchoir*', or that the bone has a few flakes removed (flaking similar to that done on stone) or that the bone looks polished. Whether this type of modification of bone is considered significantly new behaviour is perhaps open to debate. On the one hand, it can be argued that this is simple use of bone as a raw material and that it differs substantially from the elaborate shaping of bone (and of other, non-stone, raw materials) that characterises the Aurignacian. On the other hand, such examples can be taken to indicate Neanderthals' use of bone as a raw material for the making of tools rather than simply their viewing bones as food debris. This latter interpretation questions perhaps the notion of domain-specific intelligence which has been argued to characterise Neanderthals (Mithen 1996). Even if philosophically we accept these as indicative of radically new behaviour on the part of Neanderthals, it is clear that before heralding any of these as examples of new behaviour, they would need to be re-examined, as has been done by Villa and d'Errico (2001) or Armand and Delagnes (1998) for other regions and periods, and as is currently being done by Daujeard (2004; Moncel *et al.* 2004) for the Mediterranean France multi-stratified Mousterian site of Saint Marcel, to ensure that the modification was indeed hominin-created rather than caused by other agents. As it stands, these few Mousterian pieces are barely even discussed or described.

Regarding decorative artefacts/art/ornaments, a limestone piece resembling a human form and a shiny limonite were reported at the site of Mitg (Blaize 1986, 136–137, 1986–1987, 97–98) and two unperforated fossil *Turritella* shells, whose closest outcrop is 10 km away, were found in the Mousterian level of Belvis (Sacchi 1989, personal communication 2005; Sacchi *et al.* 1993; Taborin 1993). Once again, however, the interpretation of such pieces is open to debate. Some might view these as simple curiosity and/or appreciation of beauty on the part of Neanderthals, but without significant behavioural meaning (Chase and Dibble 1987; Sacchi 1989, 74), whereas others might view these as more, as has been interpreted for other similar objects elsewhere (Hayden 1993).

Aurignacian

Does the Aurignacian of Mediterranean France clearly indicate a substantial use of new, non-lithic raw materials, ornaments and decoration as does some of its neighbouring regions? Figure 13.3 shows the percentage of Aurignacian assemblages of Mediterranean France (n = 23) possessing each artefact type; for example, the percentage of sites having worked bone/antler/ivory artefacts is 48 % (by contrast, in the Mousterian, it is only 14/194 (7%), and that if *retouchoirs* are considered 'worked bone'). Clearly, aside from decorated artefacts/parietal art, the frequency of appearance of the other artefact types under consideration here is fairly decent, hovering between 17–50 % of Aurignacian assemblages.

Looking at the percentage of assemblages simply *possessing* each of these artefact types is not the whole picture, however. The *number, i.e.*, the prevalence, of each of these artefact types per assemblage is important as well in knowing whether the transition in Mediterranean France was marked or was minimal, *i.e.*, the extent of change.

Thus, the frequencies of each main artefact type were plotted as bar charts: non-shell ornaments (Figure 13.4); shell ornaments (Figure 13.5), decorated artefacts + parietal art (Figure 13.6); worked bone/antler/ivory (Figure 13.7), the latter including split-base bone/antler points. In each of these, the horizontal axis represents the quantity of the particular artefact type (except in the case of Figure 13.6 where the qualitative 'presence'/'absence' label is used) and the vertical axis represents the number of Aurignacian assemblages of Mediterranean France possessing each particular quantity of artefacts. As an example, Figure 13.4 shows that 4 assemblages have 1 non-shell ornament. In a very small number of cases, the quantity of an artefact type was not explicitly stated and/or varied between publications, and/or the attribution of an item to one of these artefact types was questionable according to published information. The relevant cells of Table 13.1 list how such cases were treated in the graphs.

These graphs clearly indicate that although these artefact types are *present* in a good number of assemblages, as shown in Figure 13.3, the *quantity* of such artefacts per assemblage is often extremely small, often on the order of 1 or 2 of the particular artefact type. For shell ornaments, in particular, this low frequency is surely surprising given this region's proximity to the Mediterranean Sea and thus to a large source of shells.

All of these graphs have similar shape: a large number of assemblages have none of the artefact (12–21 assemblages out of 23, depending on the artefact type) and the assemblages that do contain the artefact have very low numbers of them. This would likely be viewed as indicating that the Middle to Upper Palaeolithic transition was minimal in Mediterranean France – *i.e.*, that the extent of change was not substantial from the preceding Mousterian given that many Aurignacian assemblages have either no ornaments, and/or no worked bone/antler/ivory, and/or no decorated artefacts/art, just as is the case in the Mousterian.

Is this conclusion really warranted, however? As mentioned above, there are a number of non-behavioural, taphonomic and excavation factors, which could affect the results, namely, recovery methods, faunal preservation and area of excavation. Thus, the same bar charts were plotted, this time taking into account these factors to see to what extent they might be playing a role.

A summary of how each assemblage is affected by these factors is listed in column M of Table 13.1, based on the more detailed information provided in the rest of the table (especially columns E, F, K). A question mark indicates that it is not certain whether this factor is affecting the assemblage, as described in more detail in the other columns of Table 13.1. These cases were treated as assemblages potentially affected by the non-behavioural factor.

These second graphs (Figures 13.8–13.11) are identical to the first set of graphs, except that those assemblages potentially affected by a taphonomic/excavation factor are indicated in grey and are listed as 'Assemblages potentially affected by non-behavioural factor(s)' in the legend. So, for instance, looking at Figure 13.11, there are 9 Mediterranean France Aurignacian assemblages having 0 worked bone/antler/ivory artefacts which are potentially affected by a taphonomic/excavation factor. The white part of the bars, listed as 'Factors fine' in the legend of each graph, indicates the assemblages free from these potential taphonomic/excavation factors.

This does not mean that the lack, or low quantity, of such artefacts is *necessarily* due to non-behavioural factors: perhaps there were never, or few of, these artefacts to begin with, but the fact is that in such sites the real cause (behaviour or taphonomic/excavation) is unknown and as we want our conclusions to relate to the effects of behaviour, it is safer to identify such assemblages before drawing conclusions about the past.

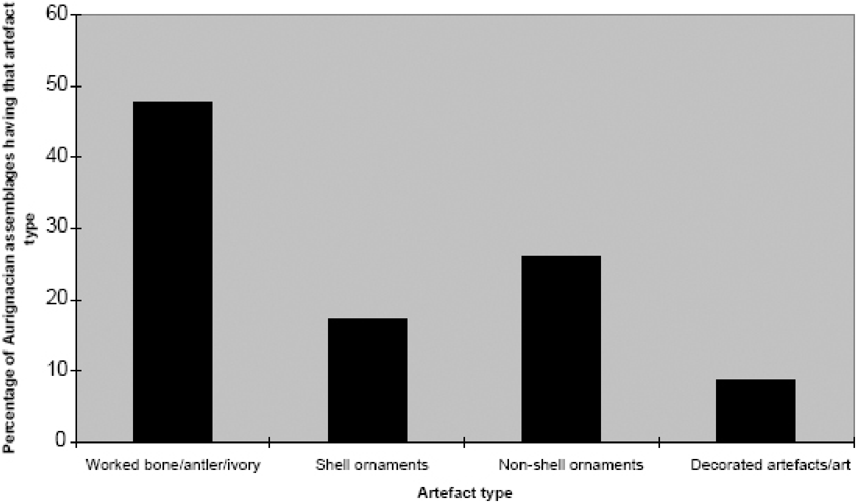


Figure 13.3 Frequency of presence of various artefact types in the Mediterranean France Aurignacian (n=23 assemblages; assemblages included are those listed in Table 13.1)

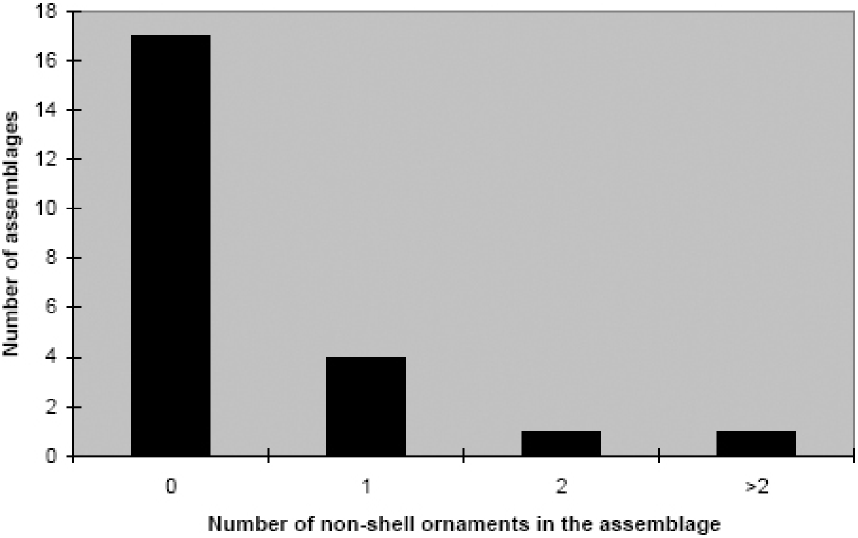


Figure 13.4 Frequency of non-shell ornaments in Mediterranean France Aurignacian assemblages (n=23 assemblages; assemblages included are those listed in Table 13.1)

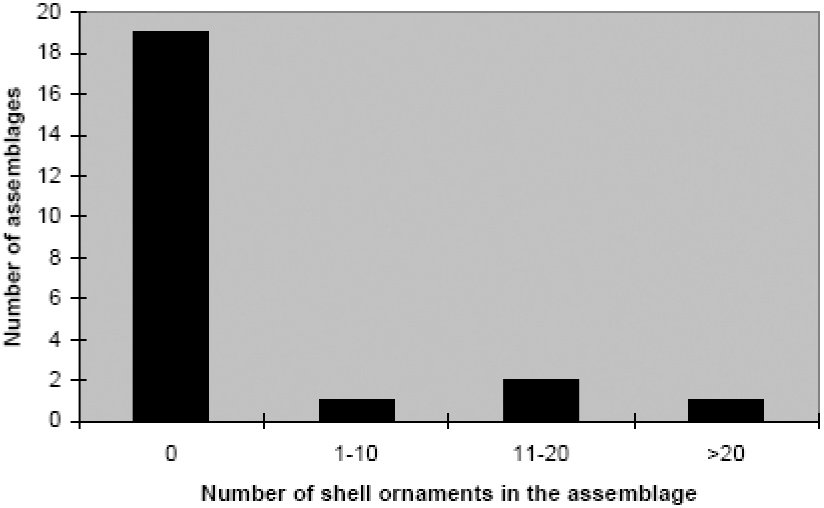


Figure 13.5 Frequency of shell ornaments in Mediterranean France Aurignacian assemblages (n = 23 assemblages; assemblages included are those listed in Table 13.1)

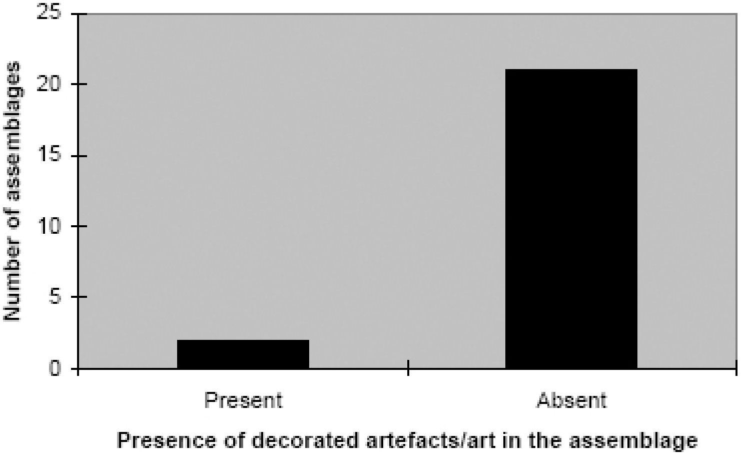


Figure 13.6 Frequency of presence of decorated artefacts/art in the Mediterranean France Aurignacian (n = 23 assemblages; assemblages included are those listed in Table 13.1)

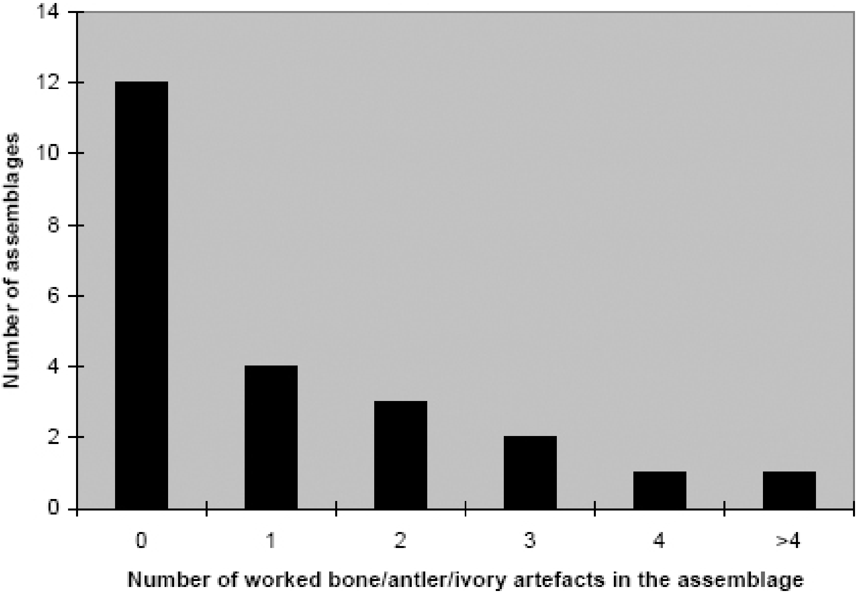


Figure 13.7 Frequency of worked bone/antler/ivory artefacts in Mediterranean France Aurignacian assemblages (n=23 assemblages; assemblages included are those listed in Table 13.1)

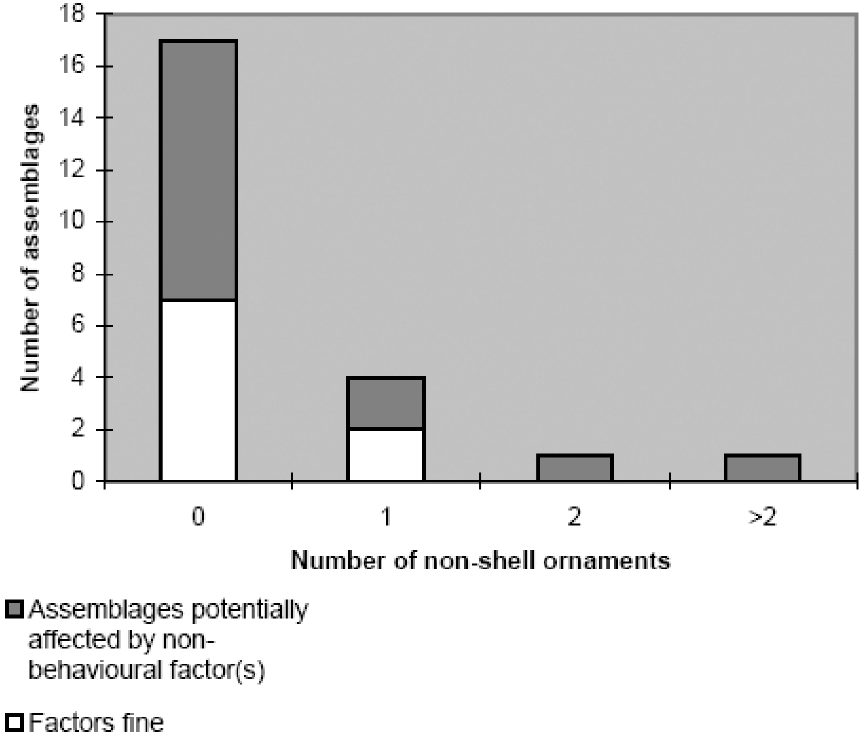


Figure 13.8 Frequency of non-shell ornaments in Aurignacian assemblages from Mediterranean France, specifically indicating assemblages potentially affected by taphonomic/excavation factors (compare to Figure 13.4) (n=23 assemblages; assemblages included are those listed in Table 13.1)

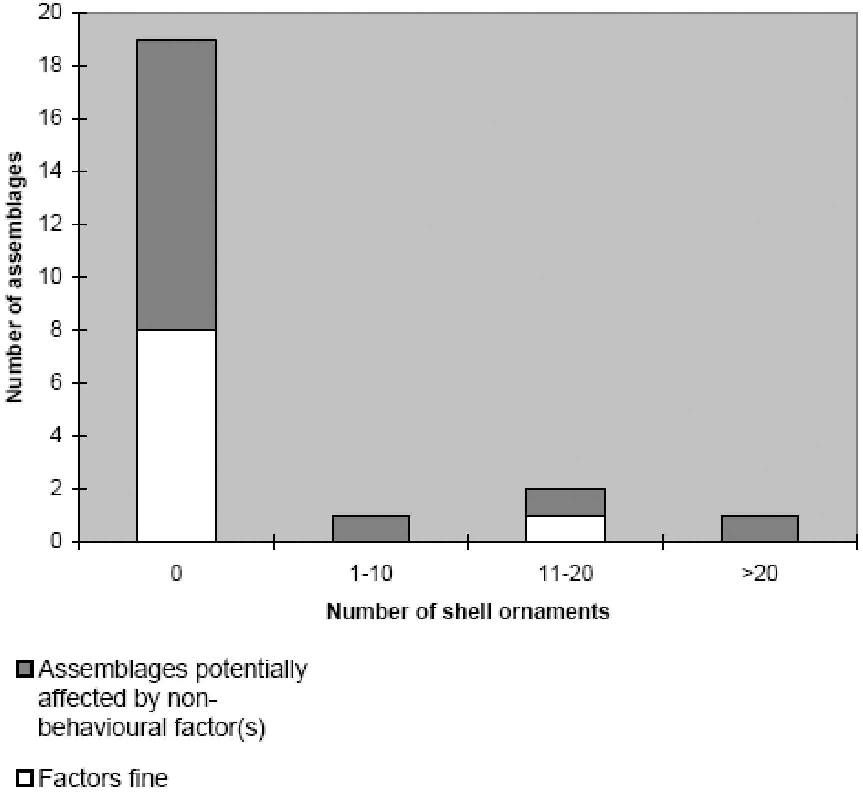


Figure 13.9 Frequency of shell ornaments in Aurignacian assemblages from Mediterranean France, specifically indicating assemblages potentially affected by taphonomic/excavation factors (compare to Figure 13.5) (n = 23 assemblages; assemblages included are those listed in Table 13.1)

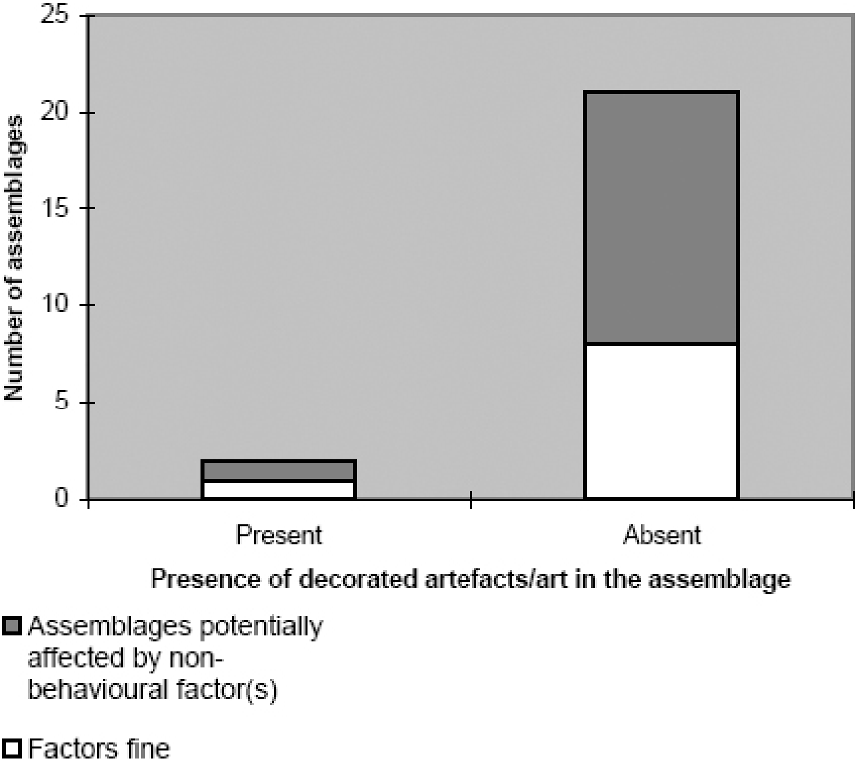


Figure 13.10 Presence of decorated artefacts/art in Aurignacian assemblages from Mediterranean France, specifically indicating assemblages potentially affected by taphonomic/excavation factors (compare to Figure 13.6) (n = 23 assemblages; assemblages included are those listed in Table 13.1)

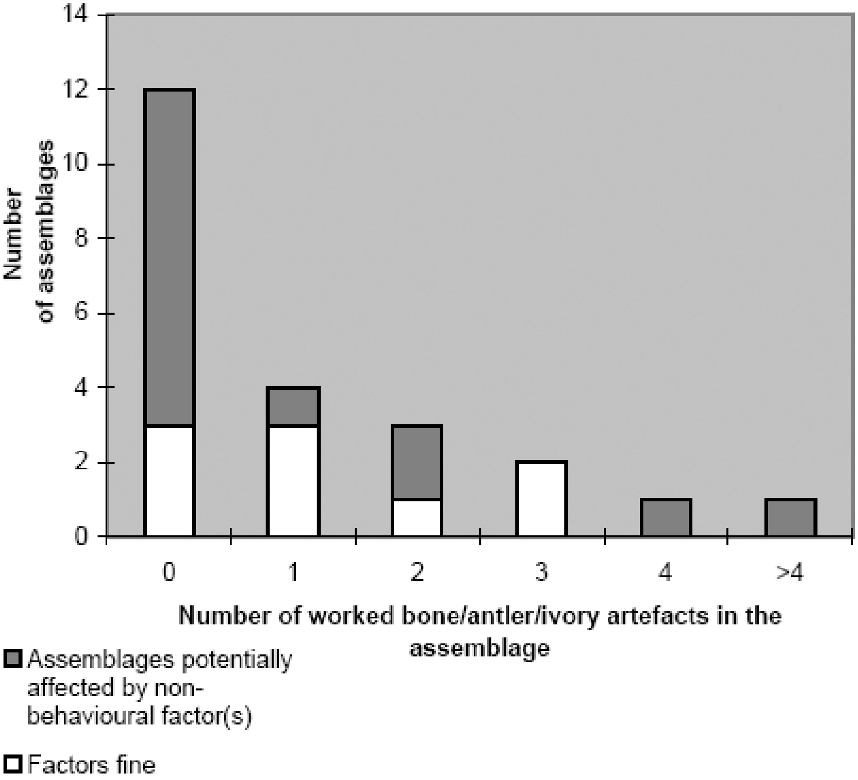


Figure 13.11 Frequency of worked bone/antler/ivory artefacts in Aurignacian assemblages from Mediterranean France, specifically indicating assemblages potentially affected by taphonomic/ excavation factors (compare to Figure 13.7) (n = 23 assemblages; assemblages included are those listed in Table 13.1)

What Figures 13.8–13.11 show is that not only does the number of assemblages not having the artefact (the '0' category) drop tremendously when these factors are taken into consideration, but also, very importantly, a number of assemblages possessing the artefact-type are affected by one or more factors such that the quantity of the artefact-type in that assemblage is, if anything, very possibly underestimated (given that all of these taphonomic/excavation factors work, if anything, in the direction of decreasing the number of artefacts).

Discussion regarding the Middle to Upper Palaeolithic transition in Mediterranean France and wider implications

To get back to the main issue raised at the beginning of this paper: "Does the Aurignacian of Mediterranean France clearly indicate a substantial use of artefacts which are considered to be a critical part of the Middle to Upper Palaeolithic transition in Europe, namely, ornaments, decorative pieces, art and the frequent use of non-lithic raw materials such as bone, antler and ivory?" If so, what does this imply and is it necessarily a substantial change from the Mousterian that preceeded it? If not, why not: is it really a behavioural difference with other neighbouring regions where change has (in some areas) been noticed or is it a product of artefact recovery, preservation or excavation area?

The Aurignacian of Mediterranean France *does* contain the typical set of artefact types found elsewhere: worked bone/antler/ivory, including split-base points, ornaments of shell and teeth, decorated artefacts and incredible parietal art, and thus it clearly *does* differ from the preceding Mousterian of this region which has virtually none of these types of artefacts. Although some of these Mousterian assemblages were themselves excavated over a small surface area and/or have poor faunal preservation and/or less-than-perfect artefact recovery methods (as discussed in Szmidt 2003), the number of Mousterian sites is so great relative to the number of Aurignacian sites (over eight times the number of assemblages; over five times the number of sites) that one would have expected to find some evidence for this new behaviour in the Mousterian had it existed. Statistically speaking, if the nature of the behaviour in the Mousterian was the same as that in the Aurignacian, one would have expected to have found 8 times the number of Mousterian assemblages showing new behaviour as Aurignacian ones, yet virtually none are found. Only 16/194 Mousterian assemblages have at least one of the artefact-types being considered in this analysis, which includes artefacts that might not even be considered artefacts by all (*retouchoirs* etc.), whereas 14/23 Aurignacian assemblages have at least one of the artefact-types being considered in this analysis.

Thus, there is clearly a change in behaviour from the Middle to the Early Upper Palaeolithic periods in Mediterranean France, at least with respect to the artefact types considered here. Based on currently available data, it is difficult to judge, however, the *extent*, or *degree*, of the change, *i.e.*, whether the change is substantial or minimal given the currently small number of assemblages whose artefact quantities can be exclusively attributed to behaviour once taphonomic and excavation factors are examined and taken into account.

Recently, many researchers (Combier 1990, 276–277; Zilhão and d'Errico 1999, 58–59; Kozłowski and Otte 2000, 529; Harrold and Otte 2001, 3; Conard and Bolus 2003, 364; Straus 2005) have argued that the Middle to Upper Palaeolithic transition was very likely to have differed in its timing, specific manifestation and amount of innovation between regions and over time and thus that we are witnessing, and in fact should expect, variability between regions rather than one, unique, fixed type of transition. This view of the transition as different between regions makes a lot of sense given that each region is, to some extent, unique in its conditions (differing density of existing Neanderthal population and thus differing degree of penetrability of a region; differing quantities and accessibility of resources and thus differing degree of competition; differing types of resources and thus differing possibility of making certain artefact types etc.). To what extent this 'geographical mosaic' observed so far is real rather than, at least partially and perhaps significantly, created by taphonomic and excavation effects is not yet well known, but rather critical to investigate.

The analysis presented here clearly indicates just how extensive an issue this can be in a region and indicates just how misrepresentative could be a synthesis or global behavioural conclusions produced from a face value reading of the data from these sites. When the data are taken as they are, the Mediterranean France

Aurignacian (*sensu lato*) appears to be very poor in bone, antler, ivory artefacts, art and personal ornaments compared to other very rich areas of these artefacts such as the neighbouring southwestern and Pyrenean parts of France and other, more distant, regions. This could, in turn, have been interpreted in behavioural terms as indicating that the transition is not very marked in this region, in other words that there is a continuity with the Mousterian. At a continental scale, this face-value reading could give an impression that this area was extremely peripheral in terms of innovation and development of the Aurignacian, when, in fact, it may have been only slightly peripheral or perhaps even key. Such conclusions thus affect our view regarding continuity *versus* replacement hypotheses, our views regarding direction of influence and dispersals and our view of which were core *versus* periphery areas.

This example has important wider implications for our assessment of the Middle to Upper Palaeolithic transition in all regions. It has shown that, especially in the interpretation of data from regions where the transition seems minimal at first glance, paying attention to potential non-behavioural causes of this apparent pattern is critical because it can radically alter the results and thus the conclusions we draw about a region. It is far less problematic in regions whose sites are already rich in these artefacts because those regions, if anything, were probably even richer in these artefacts than we currently think if these same factors could be taken into account. Nevertheless, when examining continental-scale research questions such as migration patterns and direction of diffusion of ideas, the necessity of combining and comparing data from multiple sites for such analyses means that such considerations should form an integral part of such research. In essence, regarding multi-site analyses, methodologically we need to take a new direction.

A region containing spectacular art such as that at Grotte Chauvet and being located next to the Mediterranean Sea is very likely to be a region in which there is more art/decorated artefacts and shell ornaments. The results of the research presented here serve to indicate that, despite having a good number of Aurignacian sites in Mediterranean France, the image we have currently of what occurred during the Middle to Upper Palaeolithic transition in this region is surely not representative of the behaviour that went on there 30 000 to 40 000 years ago. Doing renewed fieldwork in this key region of passage, especially of sites with faunal preservation, and those where a good size area of excavation and screening could be done, would thus be especially valuable. The results also serve to show that in the larger assessment of this transition across Europe, and especially in regional-scale, multi-site research, one needs to take into account critical factors such as faunal preservation, area of excavation and method of recovery before behavioural conclusions are drawn.

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14. Early evidence of the Aurignacian in Cantabrian Iberia and the North Pyrenees

Alvaro Arrizabalaga, Federico Bernaldo de Quirós, François Bon, María-José Iriarte, José-Manuel Maíllo and Christian Normand

Abstract

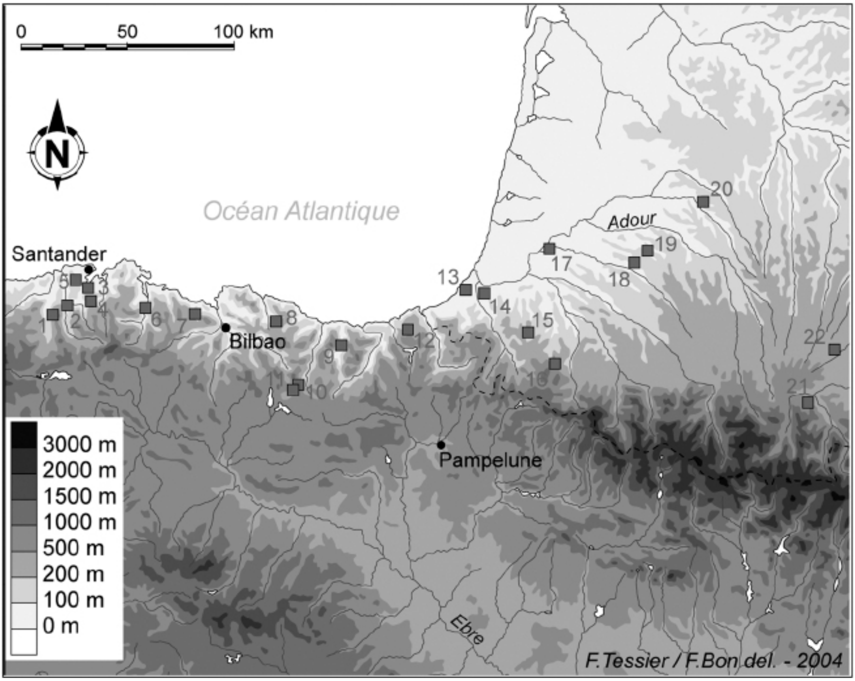
In this work we select the most conspicuous stratigraphies in a complex area (from the Cave of El Castillo, in Cantabrian Spain, to Brassempouy, in the French Landes) as a means of understanding the Middle to Upper Palaeolithic transition. Also, besides the previously mentioned sites, are the caves of Morín, Lezetxiki, Labeko Koba, Isturitz and Gatzarria. Almost all of these caves have been recently dug, or their excavation has been recently restarted after a classic phase of field work. We begin by presenting the fundamental aspects of each site, and then proceed to setting down some general evolutionary lines with reference to different aspects common to this time.

We do not wish either to exalt the quality of these sites, or to ignore their deficiencies. Some of them present problems of conservation of materials, reading and interpretation, as do all the stratigraphies (of the Upper Pleistocene) with which we are familiar. A detailed study of the materials and information that we are obtaining allows us, however, to relate these caves to each other from different points of view. All of them provide significant data about the transition process which occurred between the Middle and the Upper Palaeolithic. It seems that the evident rupture in the anthropological evidence has involved, too frequently, a parallel reading of the material, both the cultural, and even the environmental record. The complete information from the sites requires a new, unprejudiced examination, before proceeding to describe the mechanisms by which such evident change took place.

Introduction

The Aurignacian represents the earliest culture of the Upper Palaeolithic, having a wide geographical spread throughout the Southwest of Europe. Above the last Mousterian levels, and only occasionally, above Castelperronian settlements, we can find assemblages typical of the Upper Palaeolithic: blade-based lithic technocomplexes, progressive development of bone types, evidence of symbolic behaviour of a certain degree of complexity, and specialised use of the environment (raw materials, hunting and gathering, etc.). We assume, since there is no fossil register in existence, that the protagonists of these new developments were Anatomically Modern Humans.

New-style studies carried out during the last four decades, initiated by Henri Delporte, Georges Laplace and Denise de Sonneville-Bordes, among others, have provided us with a general explanation of the mechanism whereby the first great technocomplex of the Upper Palaeolithic replaced the Mousterian, by various means: a clean break or continuity, an abrupt substitution or a gradual handing-over. The Cantabrian-Pyrenean axis (along with the French Dordogne, and the German Swabia) is one of the main reference points for the study of this phenomenon. Our paper focuses on the central part of a region, which extends from La Viña, in Asturias, to a district of Catalonia called Serinyà (the sites of L'Arbreda, Reclau Viver, etc.), both in Spain. We focus on key sites from this region and in neighbouring France, such as, El Castillo, Cueva Morín, Lezetxiki, Labeko Koba, Isturitz, Gatzarria and Brassempouy (Figure 14.1). Although we consider other aspects of the material culture, we concentrate here on the techno-typological part of the material culture of these people, since this is our main source of material for investigation of this period. Another key issue which we address concerns the internal dynamics of the period, and characterising the three great phases described within the Aurignacian: the Protoaurignacian (or Archaic Aurignacian), the Early Aurignacian (or Old, Classic, Typical, I *sensu* Peyrony, with split-base points, etc.) and the recent or Evolved Aurignacian (*évolué* in French). As we lack sufficient information (and discussion) about the Evolved Aurignacian, we are focussing here on the differences between the Protoaurignacian and the Early Aurignacian in the geographical region described above. We must also bring up the fact that a phase known as the 'Transitional Aurignacian' has been identified in the sequence of Castillo, which raises the issue as to the nature of the first manifestation of the Aurignacian techno-complex and of its links with the Cantabrian Mousterian. Yet we must point out that the acceptance of this initial phase of the Aurignacian is a subject of discussion between the authors of this article: although the 'Transitional Aurignacian' is considered as the first step in the Aurignacian sequence by some of us (F.B.d.Q. and J.-M.M.), this idea is rejected by others among us (F.B. and C.N.). We all agree with the view that this industry was likely part of the process of change which affected Mousterian societies around 40,000 BP, a process which manifested itself notably by the appearance of numerous 'Transitional' industries. Our views diverge, however, when it comes to interpreting the significance of this industry and in particular in seeing it as the origin of the Aurignacian, as the name by which it is designated ('Transitional Auignacian') suggests. For one thing, the emergence of the Aurignacian must be understood as the result of a process affecting groups spread out over a much more vast region than that which is being considered in this article. In addition, if the industry from Castillo is part of such a process, the path between it and the Aurignacian is comprised of many steps. Put another way, for many of us, the Aurignacian should not be perceived as the result of an *in situ* development of any of the last Mousterian facies, nor any of the industries termed 'transitional' whether at the Cantabrian end of Europe or at its Balkan end: it is precisely the mechanisms of interaction between groups spread out over vast regions which inform us as to the conditions of its emergence and of its development (Bon 2006; Teyssandier 2007).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F.Tessier / F.Bon del. - 2004

Figure 14.1 Main Aurignacian sites in the Cantabrian-Western Pyrenean Region. 1. Hornos de la Peña; 2. El Castillo; 3. El Pendo; 4. Cueva Morín; 5. Covalejos; 6. El Otero; 7. El Polvorín; 8. Santimamiñe, Antoliñako Koba; 9. Ekain; 10. Labeko Koba; 11. Lezetxiki; 12. Aitzbitarte III; 13. Chabiague; 14. Le Basté; 15. Isturitz; 16. Gatzarria; 17. Tercis, Moulin de Bénesse; 18. Brassempouy; 19. Garet; 20. Cazaubon; 21. Gargas; 22. Les Abeilles.

Be that as it may, the aim of this paper is to give an up-to-date outline of the field and laboratory work regarding the end of the Mousterian and the beginning of the Upper Palaeolithic in this broad area, on both sides of the Pyrenees (specifically, from El Castillo Cave to Brassempouy cave). Given that it is an especially controversial period and one which is subject to permanent debate, we prefer to give priority to the presentation of the sites and information about them, while giving more secondary attention to the discussion of the larger debates of this transition, insofar as, for the latter, we will often be expressing opinions.

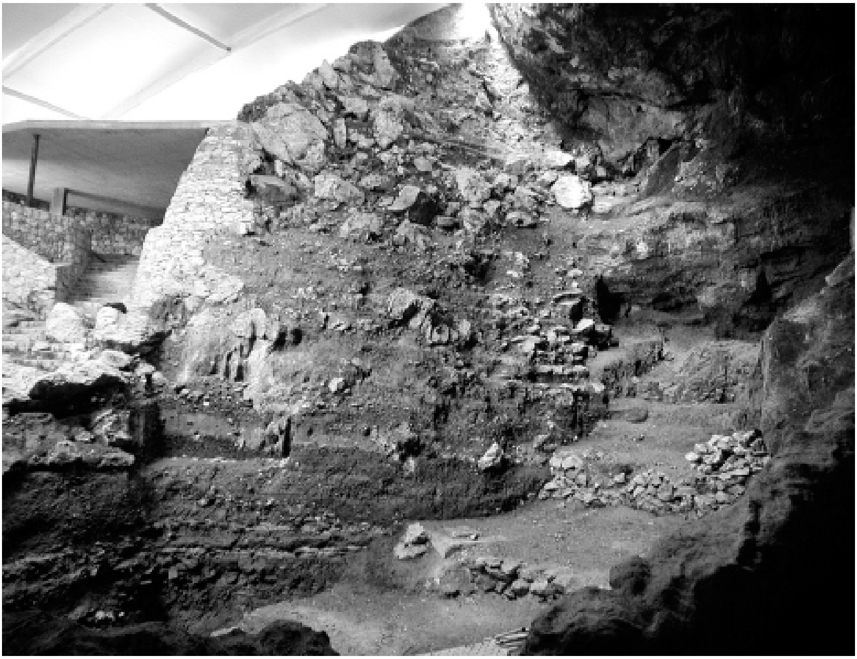


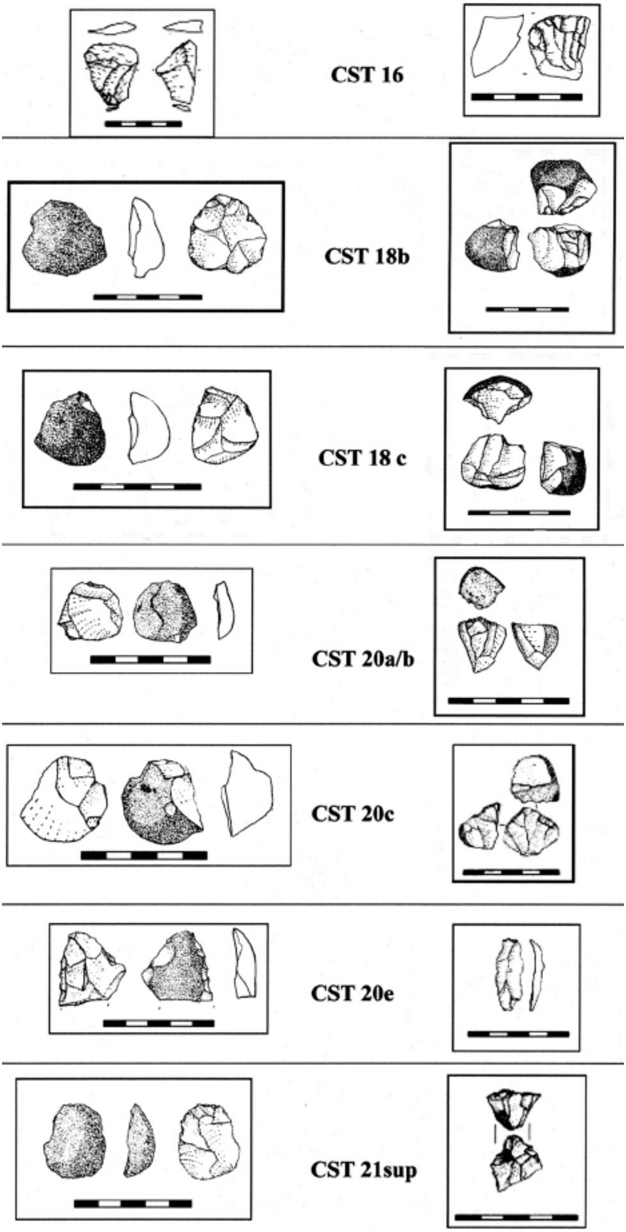
Figure 14.2 General view of the stratigraphy of El Castillo.

The most recent field research in the Pyrenean/Cantabrian region

Research over the last fifteen years has generated a large amount of information for the area described, in terms of archaeological materials, radiometric dates, analysis and synthesis. This factor, which affects the period, has a direct impact on the interest generated by the transition from the Middle to the Upper Palaeolithic (assuming the phyletic change between the Neandertal and Cro-Magnon types) in this region, in which we can see an apparent chronological overlap between the occurrences of all types, supposedly characteristic of both species. For this reason, we believe it is important to present some of the innovations which have been observed in field work in recent years.

El Castillo Cave (Puente Viesgo, Cantabria, Spain)

El Castillo Cave was discovered by Alcalde del Río in 1903. From 1910, financed by the Institut de Paléontologie Humaine in Paris, Hugo Obermaier and Paul Wernert began the main excavation which continued until 1914, when the outbreak of the First World War brought it to an end. In 1973, Victoria Cabrera began to study the site again, analyzing and publishing (Cabrera 1984) previously unpublished documents and the materials recovered by Obermaier. At the same time, archaeological excavations on the site were resumed in 1980 by an interdisciplinary team, directed by Victoria Cabrera and Federico Bernaldo de Quirós (Cabrera and Bernaldo de Quirós 2000). This recent research and renewed fieldwork has offered a contrasted chronological framework, through dating carried out using a variety of physical-chemical methods, such as AMS radiocarbon, ESR and U/Th. The dates situate these levels of human occupation between 150,000 and 30,000 years ago. The stratigraphy includes occupations from the Middle Palaeolithic: units 26 to 20, and the entire Upper Palaeolithic (with levels of Aurignacian: units 18 and 16, Gravettian: units 14 and 12), Solutrean (unit 10), Magdalenian (Lower Magdalenian: unit 8, Upper Magdalenian: unit 6) and Azilian (unit 4). These were horizontal, with no major breaks in them, in which the occupation levels were clearly separated by sterile ones formed after the rockfalls in a closed situation in which the rockfalls acted as a dam, protecting the sediments from being worked on and preventing their mixing (Figure 14.2).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CST 18b
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Figure 14.3 Technological evolution at El Castillo (discoid -s.l.- on the left, laminar on the right).

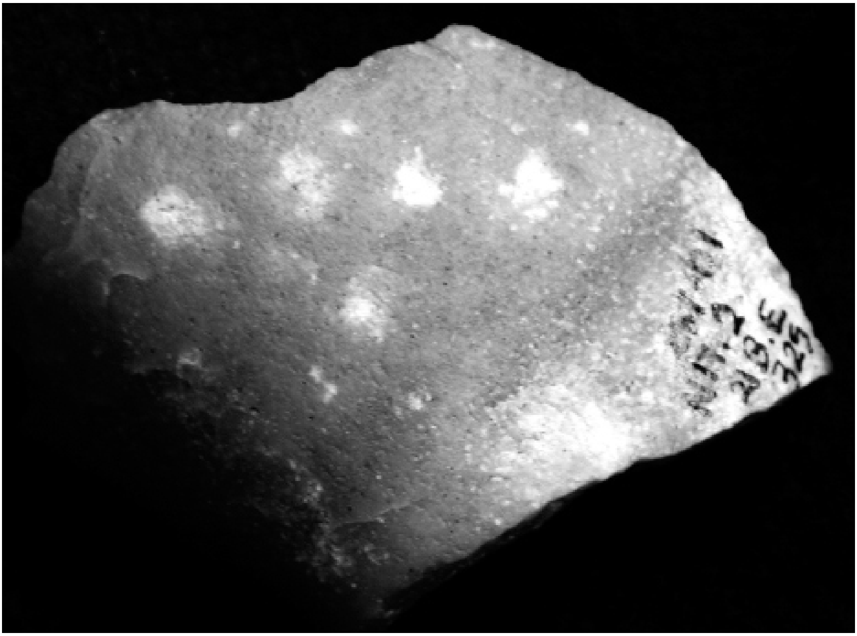
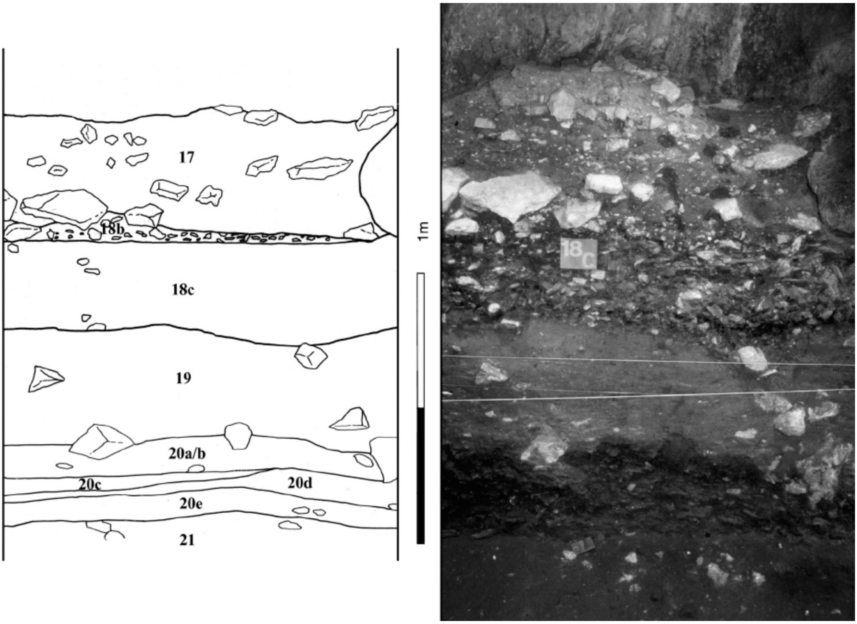


Figure 14.4 Decorated cobble from Level 21 of El Castillo.

Recent research has focussed on the exterior area of the hall, particularly the levels related to the Mousterian and the beginning of the Upper Palaeolithic, which have already been the subject of a complete series of dates (Cabrera *et al.* 1997, 2000, 2001). Unit 20, which is Mousterian, has been divided into four levels: 20 a/b, 20c, 20d and 20e, all of them characterised by the presence of a Charentian Mousterian with cleavers (Cabrera 1983). Together with the characteristic discoidal reduction sequence, we also find bladelet production. The latter implies important continuity with the Transitional Aurignacian levels which are located above them, but separated from them by a sterile layer of 40–50cm (Maíllo *et al.* 2004) (Figure 14.3). In the Mousterian, we find at least two hearths of charcoal concentrations in 20c1 and 20c3. Without any hiatus beneath this is level 21, whose characteristics are still being studied but in which was found a decorated stone of fine grey quartz, of the same type used in the production of tools (Type C1 in Cabrera *et al.* 1996a, 2000, 87). The stone, 5.7 cm long, has an alignment of four, regularly spaced pecked areas, made by tapping, above which there is a fifth pecked area. One of the key points to note is the non-utilitarian nature of these marks, which clearly differ from the other marks that can be found on lithic elements, such as those produced during carving or by accidental blows (Maíllo *et al.* 2004) (Figure 14.4). Other evidence of the non-utilitarian character is the alignment of the points themselves, which is very unlikely to have been produced by natural causes given that this phenomenon has not been found on other pieces. This ingenious characteristic implies that it must be related to some type of symbolic relationship which, together with the existence of more stereotyped symbolic elements in levels 18b and 18c above, offers us an argument in favour of continuity, not only technical and typological, but also of attitudes linked to the social behaviour of the human groups which occupied the El Castillo Cave during these periods.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1m
18c

Figure 14.5 Detailed stratigraphy of the Transition at El Castillo.

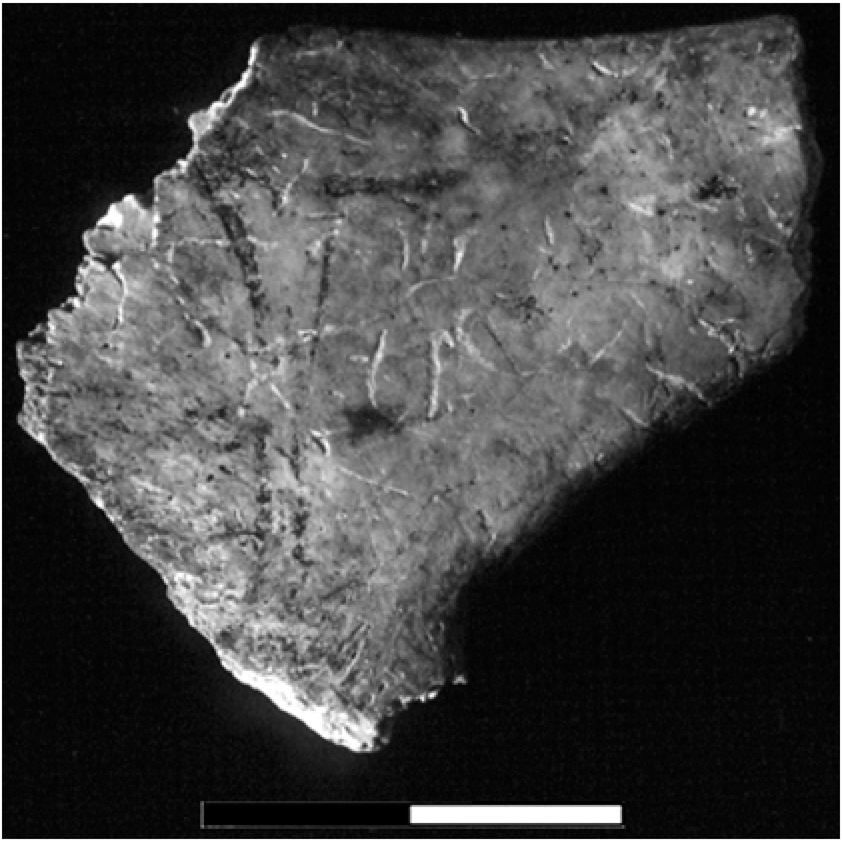

Figure 14.6 Incised deer hyoids from Level 18b of El Castillo, showing a leg (?) and the bottom of an animal, made with a manganese pencil.

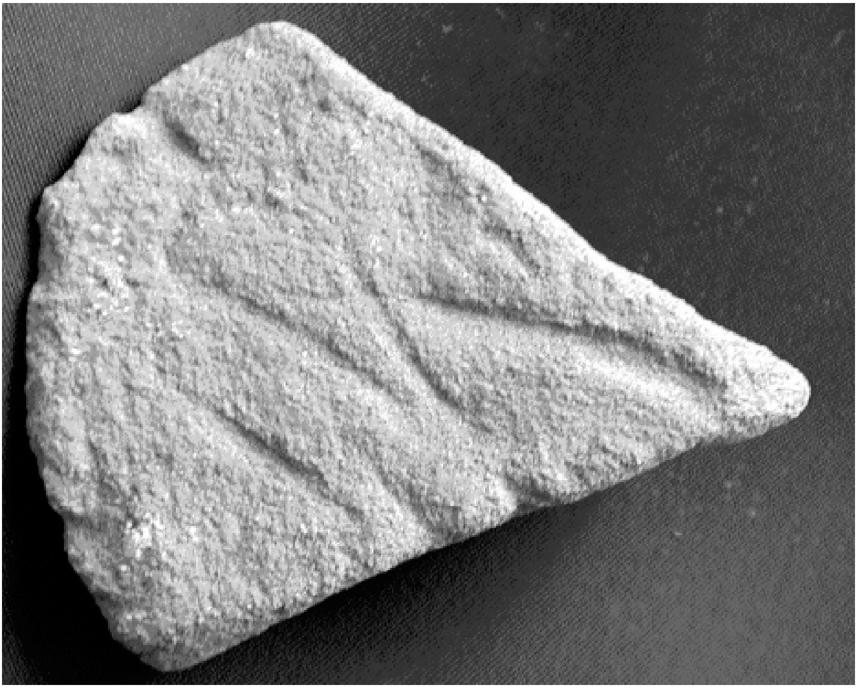

Figure 14.7 Sandstone of El Castillo decorated with some wavy lines on the upper surface and notches on the edge.

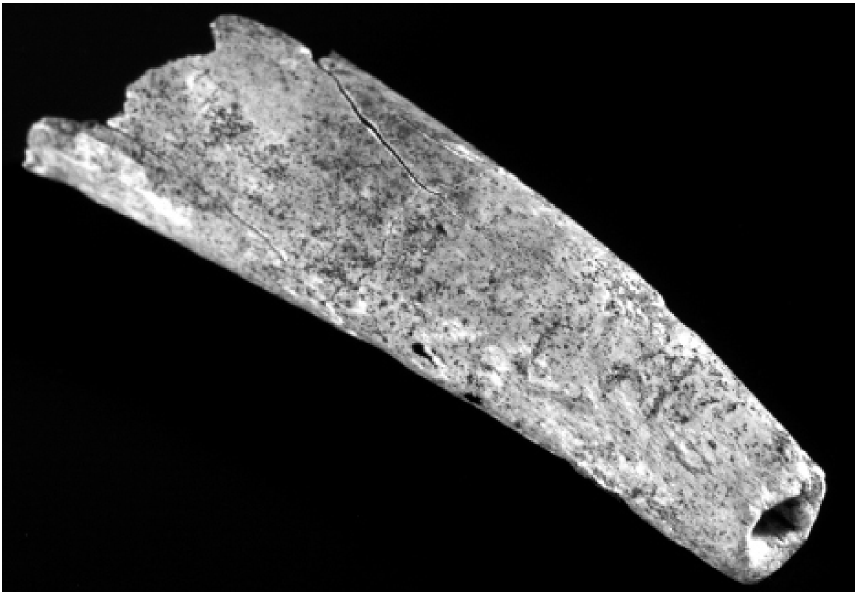

Figure 14.8 Haft made from a deer antler, one can see clearly the worked area on the tip of the

antler point. El Castillo.

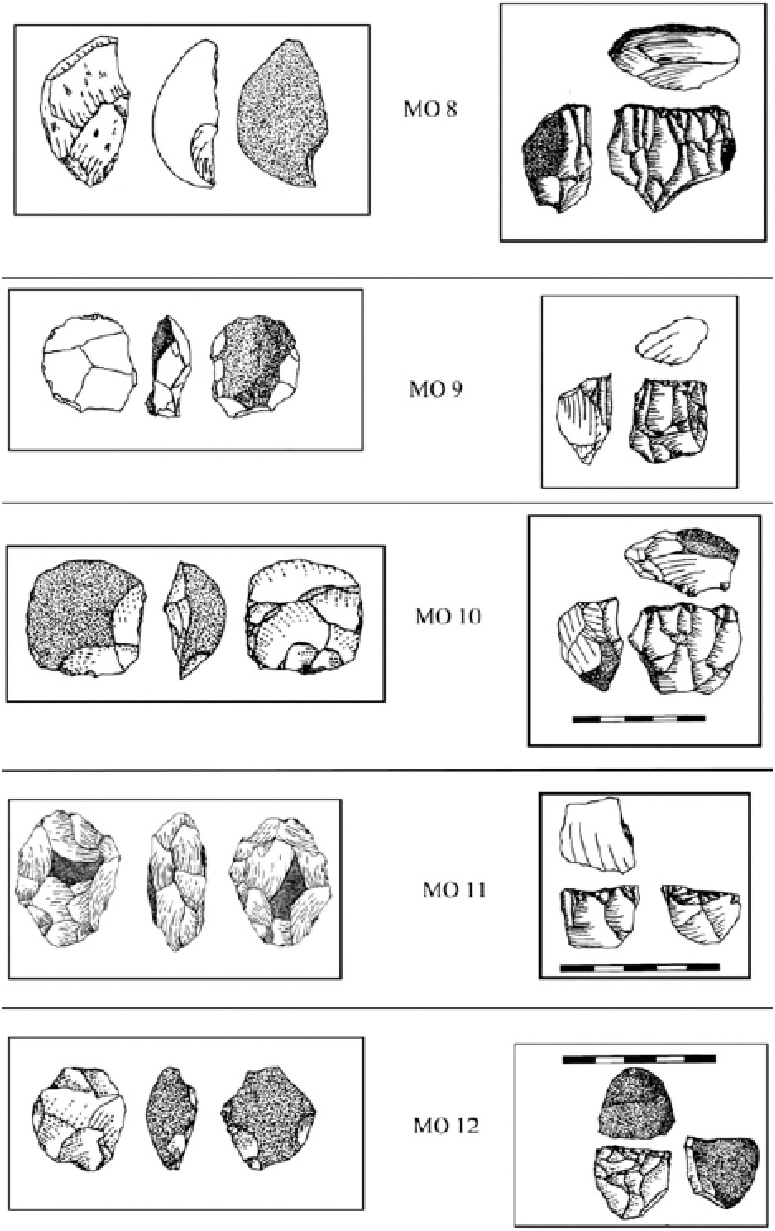
MO 8
MO 9
MO 10
MO 11
MO 12

Figure 14.9: Blade and discoidal lithic production in Middle to Upper Palaeolithic Transition of Cueva Morín.

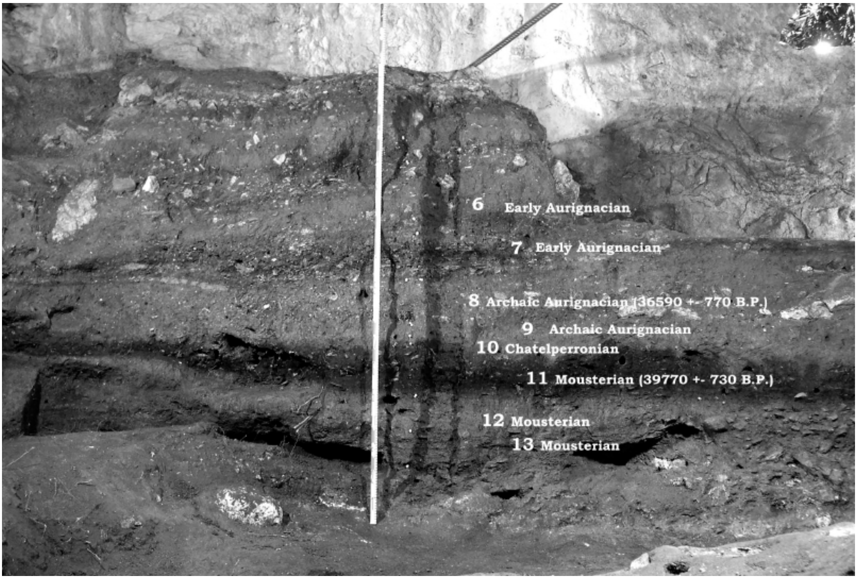

Figure 14.10 Stratigraphic profile of Cueva Morín.

Unit 18 corresponds to the reoccupation of the cave after an external collapse which sealed Unit 20 and formed the sterile Unit 19 (Figure 14.5). Evidence has been found which has highlighted the importance of this site in the processes of the transition to the Upper Palaeolithic. This unit is divided into two levels that show different activities. Level 18c contains the oldest hunter-gatherer occupation level of the Upper Palaeolithic, and there are abundant remains of charcoal in an area where they swept their fires to make new ones. From the remains, we can deduce that 40 000 years ago they had specialised hunting of deer, mainly of prime-age individuals (Pike-Tay *et al.* 1999, Dari 2003). They also used the antlers of this animal as a raw material to produce spear points. The stone tool technology shows clear indications of the Upper Palaeolithic (Aurignacian) traditions, with the presence of elements containing symbolic markings. Level 18b was formed in a slightly later occupation, dated around 38 500, in which there are features similar to the earlier period in terms of lithic technology and hunting strategies (Pike-Tay *et al.* 1999). It differs, though, in the activities carried out (butchery), with an intensification in symbolic activivities. In this same level, we also found symbolic elements such as a decorated hyoid (Figure 14.6), an incised sandstone (Figure 14.7) and some bone tools such as a tool haft (Figure 14.8).

Cueva Morín (Villanueva de Villaescusa, Cantabria, Spain)

Cueva Morín is in Villanueva de Villaescusa (Cantabria), some nine kilometres from the city of Santander. It was discovered by H. Obermaier and P. Wernert in 1910 and excavated by J. Carballo and the Count of la Vega del Sella between 1917 and 1919 (Carballo 1923; Vega del Sella 1921). The most recent archaeological intervention on the site was carried out by a Spanish-US team led by J. González-Echegaray and L. G. Freeman (González Echegaray and Freeman

1971, 1973, 1978). Later studies on the lithic industry recovered in these fieldwork seasons were carried out by A. Arrizabalaga (1995) for the Early Upper Palaeolithic and J. M. Maíllo (2003) for the Transition between the Middle and the Upper Palaeolithic. Cueva Morín represents one of the key stratigraphies for information relating to the Middle and Upper Palaeolithic in the region of Cantabria. It is represented by 22 levels, which span the Mousterian to the Azilian.

As far as the Transition from the Middle to the Upper Palaeolithic, and the first stages of the Aurignacian are concerned, materials relating to seven archaeological levels are represented: two corresponding to the Final Mousterian (12 and 11), one being Chatelperronian (10); two belonging to the Protoaurignacian or Archaic Aurignacian (9 and 8) and two corresponding to the Early Aurignacian (7 and 6) (Figure 14.9). In opposition to the opinion of some scholars (Muñoz and Montes 2004), we believe that the site formation processes are relatively uncomplicated from a taphonomic perspective (Figure 14.10). There is a well-known and topographically very specifically located stratigraphical perturbation in the entrance area, but it is caused, in our view, by a deformation by charge (Maíllo 2005a), rather than by solifluction as other authors have proposed (Sanguino *et al.* 2005).

Table 14.1 Radiocarbon dates (dates in B.C.). Industry: M: Mousterian; Ch: Chatelperronian; AA: Archaic Aurignacian; EA: Early Aurignacian; AT: Aurignacian of Transition; A s.l.: Aurignacian sensu lato.*

Site	*Level*	*Lab Number*	*Method*	*Result*	*Source*	*Industry*
Morín	11	GifA 96264	Charcoal AMS	39 770 ± 730	Maíllo *et al.* 2001	M
Morín	10	SI-951	Charcoal	26 660 ± 577*	Stuckenrath 1978	Ch
Morín	10	SI-951A	Charcoal	35 000 ± 6777*	Stuckenrath 1978	Ch
Morín	8a	SI-952	Charcoal	26 485 ± 556*	Stuckenrath 1978	AA
Morín	8a	SI-952A	Charcoal	26 205 ± 757*	Stuckenrath 1978	AA
Morín	8a	SI-956	Charcoal	26 565 ± 1324*	Stuckenrath 1978	AA
Morín	8	GifA 96263	Charcoal AMS	36 590 ± 770	Maíllo *et al.* 2001	AA
Morín	7	SI-955	Charcoal	27 565 ± 865*	Stuckenrath 1978	EA
Morín	7	SI- 955A	Charcoal	26 105 ± 1535*	Stuckenrath 1978	EA
Morín	7/6	SI-954	Charcoal	30 465 ± 901*	Stuckenrath 1978	EA
Labeko Koba	IX inf	Ua-3324	Bone AMS	34 215 ± 1265	Arrizabalaga 2000	CH
Labeko Koba	IX inf	Ua-3034	Bone AMS	26 575 ± 505	Arrizabalaga 2000	Ch
Labeko Koba	IX sup	Ua-3325	Bone AMS	29 750 ± 740	Arrizabalaga 2000	AA
Labeko Koba	VII	Ua-3321	Bone AMS	31 455 ± 915	Arrizabalaga 2000	AA
Labeko Koba	VII	Ua-3320	Bone AMS	26 910 ± 530	Arrizabalaga 2000	AA
Labeko Koba	V	Ua-3322	Bone AMS	30 615 ± 820	Arrizabalaga 2000	EA
Labeko Koba	V	Ua-3035	Bone AMS	23 365 ± 350	Arrizabalaga 2000	EA
Labeko Koba	IV	Ua-3323	Bone AMS	21 665 ± 305	Arrizabalaga 2000	EA
Lezetxiki	V	IPH-LzV2	Bone Th/U	70 000 ± 9.000	Sánchez-Goñi 1993	M
Lezetxiki	V	IPH-LzV1	Bone Alpha (Th/U)	57 000 ± 2.000	Sánchez-Goñi 1993	M
Lezetxiki	IIIa	I-6144	Bone C14	19 340 ± 780	Altuna 1972	A *s.l.*
La Viña	XIV*	GifA-95521	Charcoal AMS	>47 700	Fortea 1999	M
La Viña	XIII basal	GifA-95546	Charcoal AMS	42 200 ± 2.200	Fortea 1999	M
La Viña	XIII basal	GifA-95537	Charcoal AMS	> 47 600	Fortea 1999	M
La Viña	XIII	GifA-95463	Charcoal AMS	31 860 ± 680	Fortea 1999	A
La Viña	XIII	Ly-6390	Charcoal C14conv	36 500 ± 750	Fortea 1995	A
El Castillo	20b	GifA-89144	Charcoal AMS	39 300 ± 1900	Cabrera *et al.* 1996	M
El Castillo	20b	GifA-92506	Charcoal AMS	43 300 ± 2900	Cabrera *et al.* 1996	M
El Castillo	18b	AA-2406	Charcoal AMS	38 500 ± 1800	Cabrera and Bischoff 1989	AT
El Castillo	18b	OxA-2473	Charcoal AMS	37 000 ± 2200	Hedges *et al.* 1994	AT
El Castillo	18b	AA-2407	Charcoal AMS	37 100 ± 1800	Cabrera and Bischoff 1989	AT
El Castillo	18b	OxA- 2474	Charcoal AMS	38 500 ± 1300	Hedges *et al.* 1994	AT
El Castillo	18b	OxA-2475	Charcoal AMS	40 700 ± 1600	Hedges *et al.* 1994	AT
El Castillo	18c	OxA-2478	Charcoal AMS	39 800 ± 1400	Hedges *et al.* 1994	AT
El Castillo	18c	AA-2405	Charcoal AMS	40 000 ± 2100	Cabrera and Bischoff 1989	AT
El Castillo	18c	OxA-2476	Charcoal AMS	40 700 ± 11500	Hedges *et al.* 1994	AT
El Castillo	18c	OxA-2477	Charcoal AMS	41 100 ± 1700	Hedges *et al.* 1994	AT
El Castillo	18c	GifA-89147	Charcoal AMS	39 500 ± 2000	Cabrera *et al.* 1996	AT
El Castillo	18c		Teeth ESR	40 000 ± 5000	Rink *et al.* 1997	AT
El Castillo	16	GifA-95539	Charcoal AMS	34 300 ± 1000	Cabrera *et al.* 2002.	AA
Covalejos	4	GrA-23921	Bone AMS	41 640 ± 650,530	Sanguino and Montes 2005	M
Covalejos	4	GrA-22814	Bone AMS	40 650 ± 2300,1800	Sanguino and Montes 2005	M
Covalejos	3	GrA-24220	Bone AMS	32 840 ± 280,250	Sanguino and Montes 2005	AA
Covalejos	2	GrA-22443	Bone AMS	30 380 ± 250	Sanguino and Montes 2005	EA
Brassempouy/Hyènes	2DE	GF11034	Charcoal C14conv	33 600 ± 240	Bon 2002	EA
Brassempouy/Hyènes	2DE	GF10658	Charcoal C14conv	32 410 ± 370	Bon 2002	EA
Brassempouy/Hyènes	2E	GF1035	Charcoal C14conv	31 940 ± 160	Bon 2002	EA
Brassempouy/Hyènes	2D/2F	GF9031	Charcoal C14conv	30 100 ± 400	Bon 2002	EA
Brassempouy/Hyènes	2A-2C	GF8174	Charcoal C14conv	32 190 ± 620	Bon 2002	EA
Brassempouy/Hyènes	2A-2C	GF8568	Charcoal C14conv	31 820 ± 550	Bon 2002	EA
Brassempouy/Hyènes	2A-2C	GF8569	Charcoal C14conv	31 690 ± 780	Bon 2002	EA
Brassempouy/Hyènes	2A	GifA-101093	Charcoal AMS	33 100 ± 920	Bon 2002	EA
Brassempouy/Hyènes	2F et 2DE	GifA-101094	Charcoal AMS	34 810 ± 540	Bon 2002	EA
Brassempouy/Dubalen	Ebc2	GifA-101045	Charcoal AMS	36 130 ± 690	Bon 2002	Ch
Isturitz	C4d	GifA-98237	Bone AMS	34 630 ± 560	Normand and Turq 2005	AA
Isturitz	C4d	GifA-98238	Bone AMS	36 550 ± 610	Normand and Turq 2005	AA
Isturitz	C 3b	Beta 136048	AMS	28 290 ± 240 BP	Barandiaran *et al.* 2000	AA?
Isturitz	C 3b	Beta 136049	AMS	29 400 ± 370 BP	Barandiaran *et al.* 2000	AA?

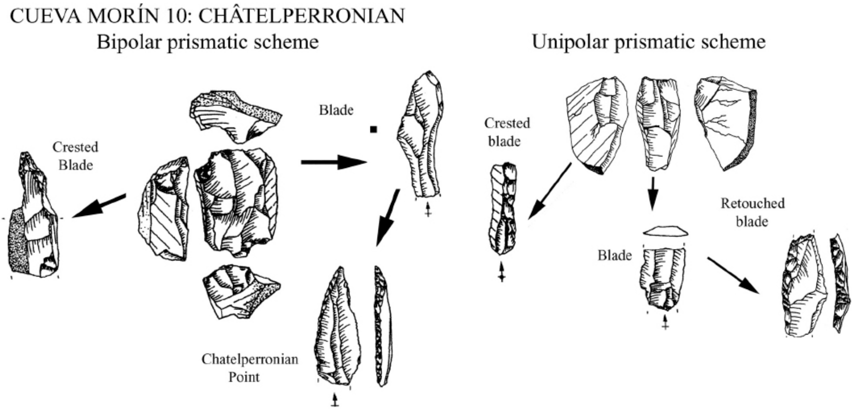

Figure 14.11 Chatelperronian bipolar and unipolar prismatic schemes.

The site has two series of radiometric dates (Table 14.1). In the first of these, dates were obtained whose results appear to be incoherent, being, in general, more recent than dates normally accepted for these prehistoric periods (Stuckenrath 1978). Recently, two new dates were obtained for levels 11 and 8 which have substantially increased the age of the levels dated previously (Maíllo *et al.* 2001). There are several explanations for the difference between the sets of dates. Firstly, dates obtained in the 1966–69 excavations are expressed in B.C. rather than in B.P. (Stuckenrath 1978). Secondly, samples dated from level 8 were taken in the central area of the cave, where the dwelling structures appeared. These structures could not be related to the western profile that serves as a stratigraphic reference for the whole sequence, the intermediate area having already been dismantled in the excavations at the beginning of the 20th century (González Echegaray and Freeman 1971). On the other hand, old dates like those of level 10 can be discarded because of their large standard deviation and the inconsistency between the various results obtained from the same sample. We are currently carrying out a new series of dates from levels 7, 6 and 5, with the aim of comparing them with those available until now (Stuckenrath 1978).

The Final Mousterian levels (11 and 12) are characterised, from a technological standpoint, by discoidal reduction of two methods: unifacial and bifacial. The raw materials are varied, but notable amongst them are flint and fine-grained quartz. The blanks are designed for the creation of denticulates and side-scrapers. There is a bladelet production scheme aimed at obtaining bladelets from unipolar prismatic cores. Some of these bladelets are retouched with semi-abrupt or abrupt retouch, although there are few examples. This bladelet production pattern is similar, in broad terms, to that of the Archaic Aurignacian, but with particular elements that differentiate it (Maíllo 2001; Maíllo *et al.* 2004). In terms of retouched artefacts, there is a dominance of denticulates and, to a lesser extent, of side-scrapers. These assemblages would correspond to a Denticulate Mousterian *sensu* Bordes. Level 11 has recently been dated to 39 770 ± 730 B.P. (GifA- 96264) (Maíllo *et al.* 2001).

The Chatelperronian of Cueva Morín (Level 10) is also dominated by discoidal cores similar to those of the Mousterian, although the laminar component is, qualitatively, more important. There are two production schemes for the manufacture of blades. The more frequent is the production scheme carried out from unipolar prismatic nuclei. The other production scheme is the one which uses bipolar prismatic nuclei (Figure 14.11). The blanks obtained by this latter method are designed for the creation of Chatelperronian points (Figure 14.12). There is no specific bladelet production. The Chatelperronian in Cueva Morín is characterised by a small number of Chatelperronian points (4.2 %), a greater number of end-scrapers than burins and a large percentage of substrate tools.

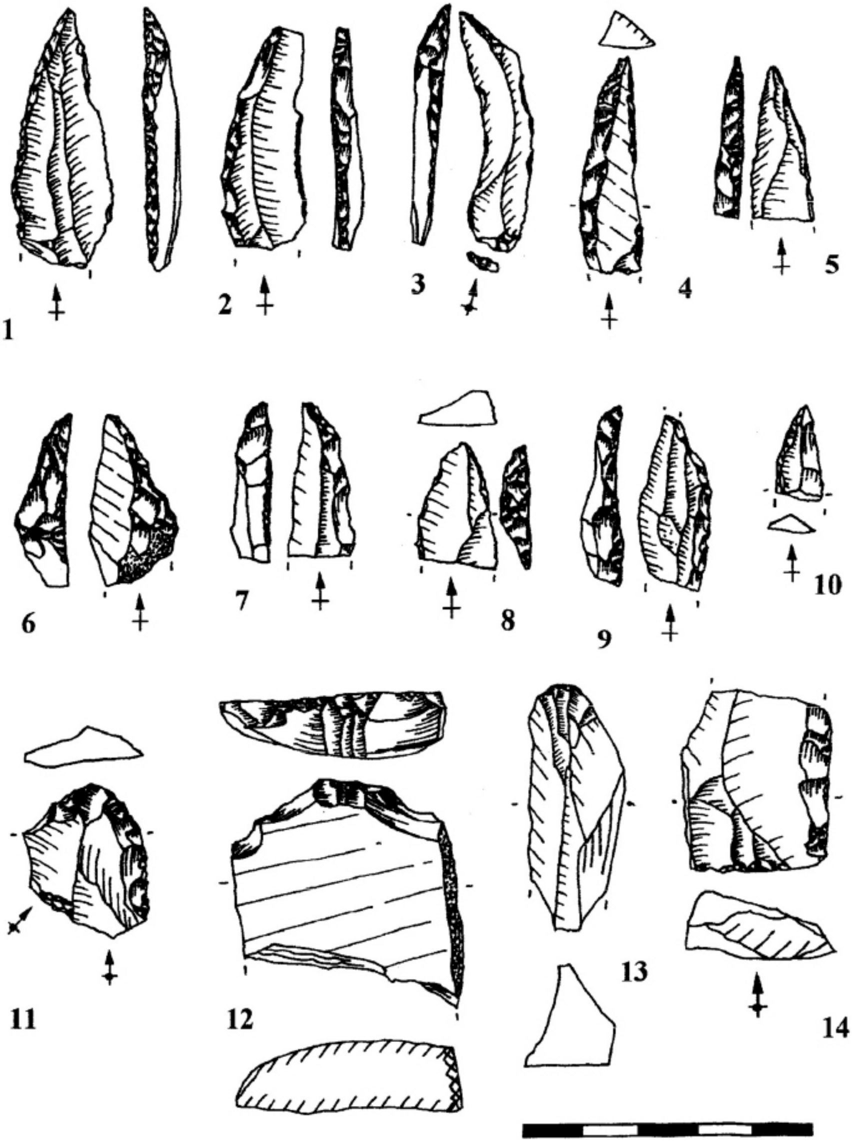

Figure 14.12 Chatelperronian points, end-scrapers and side-scrapers of 10 Level of Cueva Morín.

The Archaic Aurignacian is present in levels 9 and 8. Technologically, they are characterised by a largely increased frequency of bladelet production from unipolar prismatic cores, with a *continuum* between the production of blades and bladelets (Figure 14.13), and, to a lesser degree, through carinated end-scraper type cores (Maíllo 2005a, b). The production of blanks through the use of discoid type reduction schemes is also frequent. Typologically, the Archaic Aurignacian is defined by a high percentage of Dufour bladelets (17.9 % in level 8). Also noteworthy are the pieces exhibiting side retouch and common background, with end-scrapers being more abundant than burins. This level has recently been dated to 36 590 ± 770 B.P (GifA- 96263) (Maíllo *et al.* 2001).

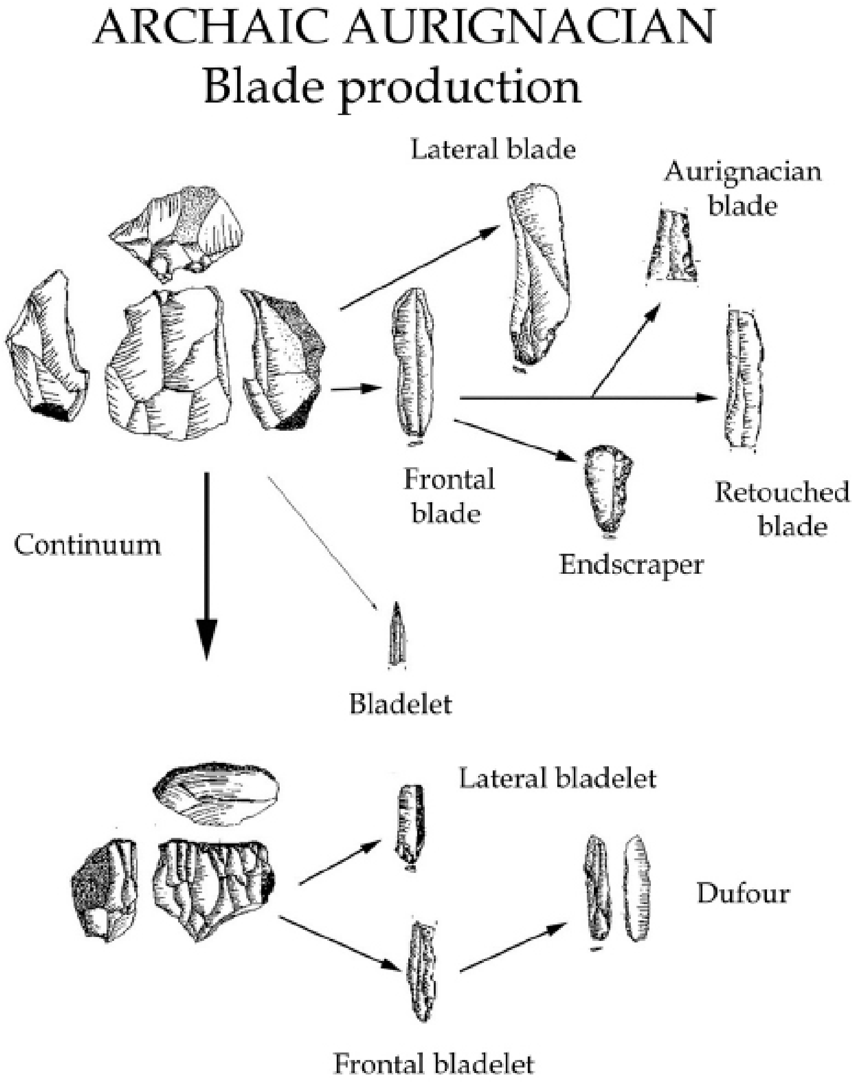
ARCHAIC AURIGNACIAN
Blade production
Lateral blade
Aurignacian blade
Frontal blade
Retouched blade
Endscraper
Continuum
Bladelet
Lateral bladelet
Dufour
Frontal bladelet

Figure 14.13 Blade and bladelet products of Cantabrian Archaic Aurignacian/Protoaurignacian.

In the Early Aurignacian, from a technological point of view, there is a dissociation between the production of blades and bladelets (Figure 14.14) and thus there is a big difference between it and the underlying Archaic Aurignacian bladelet production scheme. In the Early Aurignacian, blades are produced from unipolar prismatic cores whereas bladelets are produced from carinated end-scrapers. The production of blanks is more limited and aimed, to a large extent, at obtaining flakes from carinated cores to be used as blanks. Typologically, end-scrapers are more common than burins, especially thick scrapers. The bone industry is scarce and fragmentary. In level 7 there are two fragments of spear points with quadrangular cross-section and two others having circular cross-section, as well as a perforated deer incisor. In level 6 there is a proximal fragment of a spear point, six spear points (four with circular cross-section, one of sub-quadrangular and another sub-triangular cross-section) and a *baguette*.

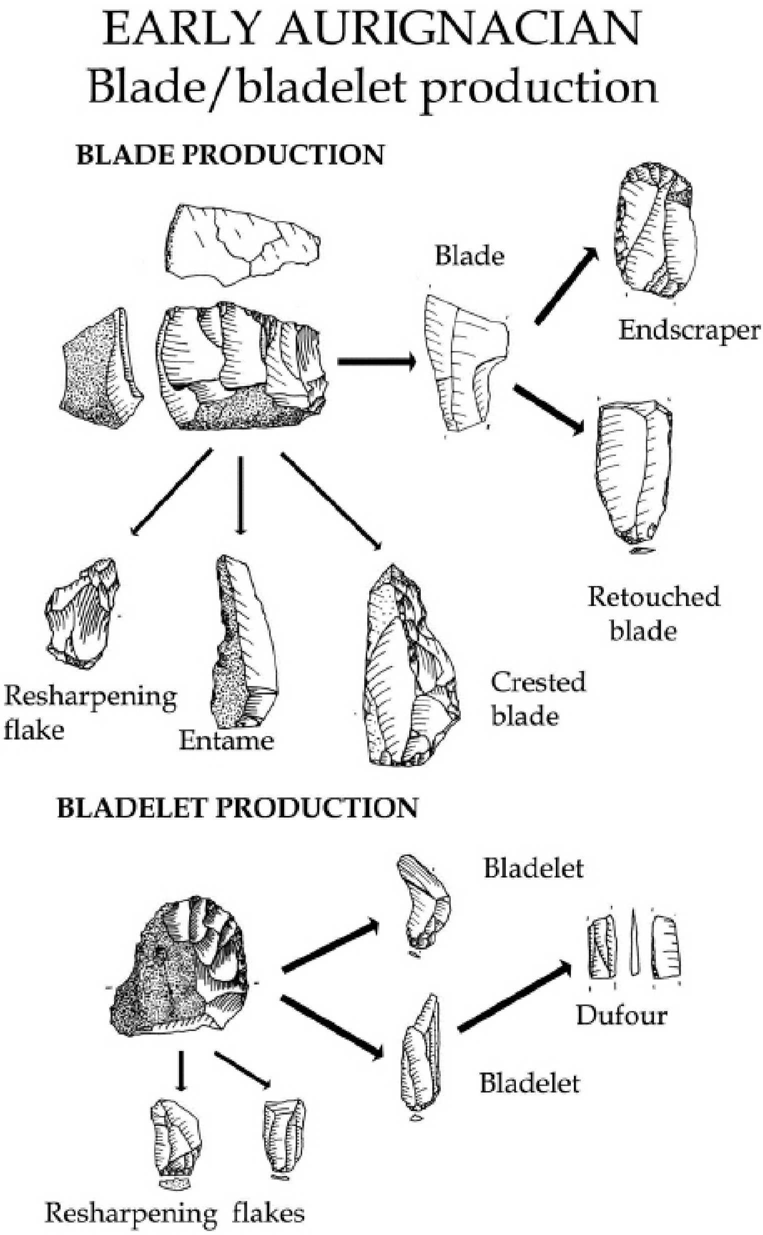
EARLY AURIGNACIAN
Blade/bladelet production
BLADE PRODUCTION
Blade
Endscraper
Retouched blade
Resharpening flake
Entame
Crested blade
BLADELET PRODUCTION
Bladelet
Dufour
Bladelet
Resharpening flakes

Figure 14.14 Blade and bladelet products of Cantabrian Early Aurignacian.

Labeko Koba (Arrasate, Basque Country, Spain)

The site of Labeko Koba, the first mention of which dates back to 1972 (Altuna *et al.* 1995) was excavated between 1987 and 1989, under the direction of A.

Arrizabalaga (Arrizabalaga and Altuna 2000; Arrizabalaga *et al*. 2003). With the monograph of the site having been published recently, we shall limit ourselves here to giving only a brief overview of the stratigraphy of the site. Labeko Koba includes a virtually uninterrupted sequence of layers from the Chatelperronian (level IX lower), to the advanced Early Aurignacian (level IV). This site offers a sequence of more than four metres' thickness, that has been deposited over a duration of about five thousand years (Table 14.1 and Figure 14.15).

There is evidence of visits to the cave by the species which rivalled each other for occupation of it (carnivores and humans) already from the base of the sequence (level IX lower). The human presence, which is very sporadic, can be interpreted in relation to the provision of biotic resources (meat, leather, antler, bone, etc.) present in the pothole from the activity of the carnivores, the main actors in the taphocoenosis of the base of the deposit. The first stages of silting at Labeko Koba, which suppose practically half of the total archaeological potency of the site, constitute the level IX (in some squares it is close to two metres thick). The sub-level Lower IX has been attributed to the Chatelperronian, although this is largely due to the percentage importance which the presence of three Chatelperronian points has on a small lithic assemblage (Figure 14.16). There is also a very deteriorated fragment of spear point. The upper section of level IX occupies the greater part of the unit and is almost totally lacking in industry (barely five flakes of flint and the same number of possible strikers made from *Megaceros* antler). The identification of these antler fragments as strikers makes up for the absence, in the same level, of other *Megaceros* bones (in spite of having more than 2350 identified remains), and the lack of similar artefacts in antler of other deer and the similar pattern in module and location of these five objects in the cave (Figure 14.17). From a cultural point view, it is complicated to assign an industrial variant type to this sub-level, which is physically positioned between the Chatelperronian level (IX lower) and the Protoaurignacian one (VII), separating them more clearly than the irregular level VIII.

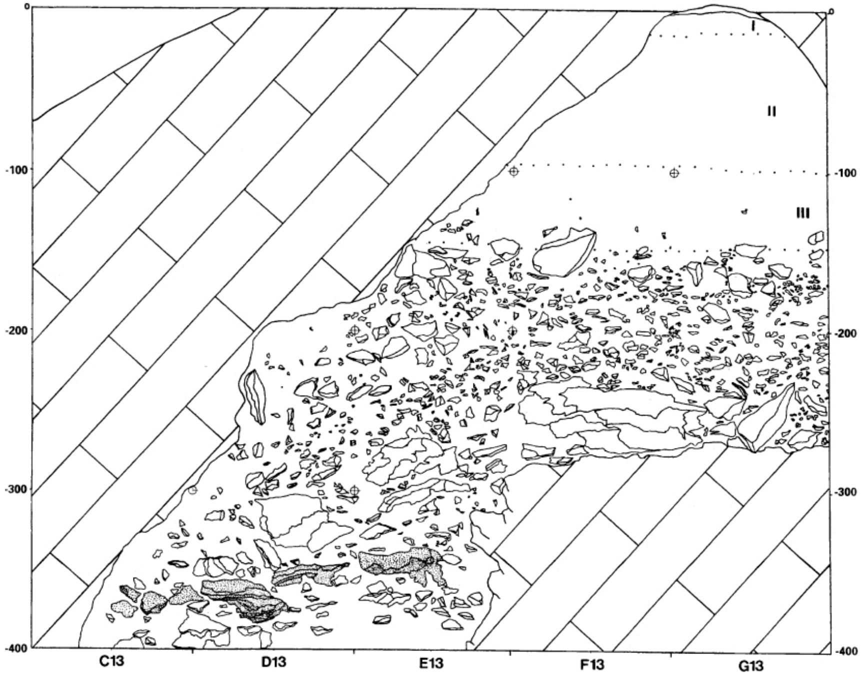

Figure 14.15 Stratigraphic profile of Labeko Koba.

As far as level VII is concerned, it displays a clear change relative to the underlying levels. For the first time in the sequence of Labeko Koba, hominins take centre stage. In particular, because of the composition of its lithic industry (Figure 14.18), this level is clearly Protoaurignacian in form, specifically because of the variety of bladelets, many with abundant semi-abrupt retouch (Dufour type). In level VII a number of remains have been recovered (a stone with engraved lines, a small ball of amber and various examples of decoration on bone) which provide evidence that, at least starting with the Protoaurignacian, these groups had a symbolic universe similar to that which will be observed throughout the Upper Palaeolithic.

Levels VII and V are separated by level VI, the latter being very poor, and appearing to lean culturally more towards level V than level VII. Although the lithic assemblage is not large there is a split-base point in this level, which identifies this occupation as Early Aurignacian. The chronological affiliation of level V is also known, in view of the existence of an almost complete split-base point. The lithic assemblages are similar (Figure 14.19), with the modal and group levels being within the parameters observed for the Early Aurignacian at other sites in Cantabria (Cueva Morín and Polvorín Cave, amongst others).

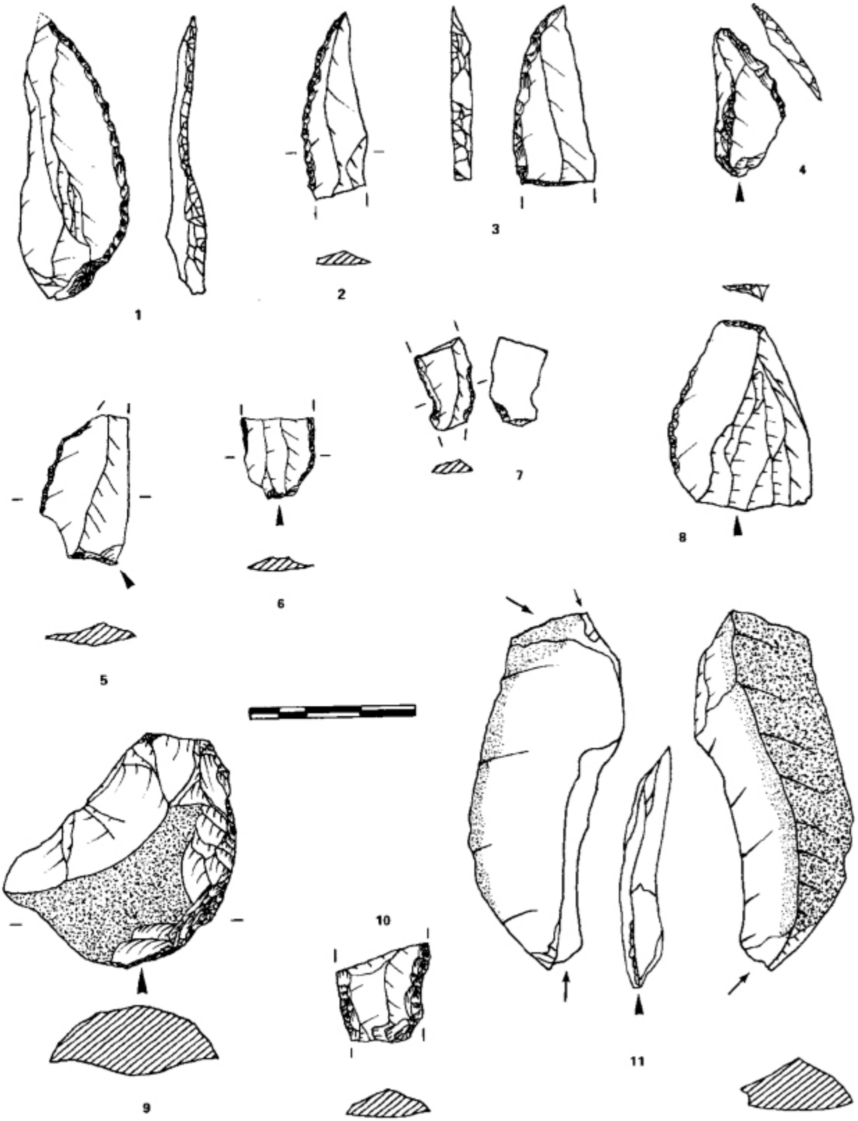

Figure 14.16 Lithics from the Lower IX Level (Chatelperronian) of Labeko Koba.

Level IV of Labeko Koba is more problematic to situate chronologically. Our main evidence for the attribution of level IV consists in its strong similarity to level V, in all aspects (environmental, sedimentary, industrial, behavioural). Focussing on the lithic assemblage (in this level, the bone industry does not provide determining information for the purposes of cultural chronology) we see that both levels (IV and V) tend to be similar. The most diagnostic lithic feature for determining cultural affiliation (the mode) shows great similarity between both levels, despite the fact that semi-abrupt retouch (on the Dufour bladelets), still strongly present in level V, almost disappears in level IV. Except for that difference the similarities between the two levels with respect to the composition of the lithic tools elaborated within the modes of simple, abrupt, burin or écaille retouch are clear.

It is also easy to find similarities to other Early Aurignacian sites (such as different levels at Gatzarria and Cueva Morín). Consequently, we shall consider level IV from Labeko Koba to be a more advanced phase of the same Early Aurignacian. We should make it clear at this point that we are not referring to an Evolved (or *évolué*, to give it its French term) Aurignacian, which has very different characteristics.

Lezetxiki (Arrasate, Basque Country, Spain)

The Archaeological Map of Guipúzcoa (Altuna *et al.* 1995) places the discovery of this site in 1927, by Justo Jauregui. The excavations began in 1956, and were extended in successive yearly field seasons until 1968 (Barandiarán 1960, 1963, 1964, 1965a, b; Barandiarán and Altuna 1966, 1967a, b, 1970; Barandiarán and Fernández-Medrano 1957; Barandiarán *et al.* 1959). The 1956–1968 samples and contextual information were recovered from a large surface area (some 75 square metres, on average) along a narrow and deep (up to nine metres) karstic tunnel. This area was very advanced for its time, with recovery of micromammals and large mammals, sedimentological analysis, a first palynological trial and radiocarbon dating). The more recent excavations (from 1996, to the present) is much more limited in area (Arrizabalaga *et al.* 2005), covering a surface area of some ten square metres in the southern part of Lezetxiki (Figure 14.20). This means it will be difficult to recover a sufficient amount of material to shed new light on what is already known about this sequence. Our effort to recover new information from the Lezetxiki sequence is aimed, however, at using a classic deposit to try to solve some questions which, in our view and understanding, were still unresolved by the earlier excavations. Similarly, we have been carrying out successive excavation campaigns in Lezetxiki II, with the aim of providing an appropriate stratigraphic context to the well-known fossil humerus found in the classic excavation. This human bone was found in a level lacking industry and fauna and thus, it has still not been possible to place it chronologically.

The levels of "transition" between the Middle and Upper Palaeolithic in Lezetxiki are, essentially, levels III and IV (the latter including two abundant sublevels, IVa and IVc). New excavation has allowed us to recognise erosion episodes between some of the levels above this series, but the part of the sequence containing levels III and IV seems intact from this point of view. Both of these levels include a significant quantity of lithic artefacts, but practically no remains of bone industry. From a techno-typological perspective and management of raw materials, these three units present ambivalent characteristics, typical of both the end of the Mousterian, and the beginning of the Upper Palaeolithic. The former excavations appeared to give indications in this direction, but have been repeatedly rejected because of the suspicion that these levels had been removed or that there had been clumsy field work. Our involvement provides the same reading, however, allowing us to rule out post-depositional alterations of this thick layer of sediment (which exceeds a metre in thickness in various areas) as the factor responsible for the characteristics of these levels.

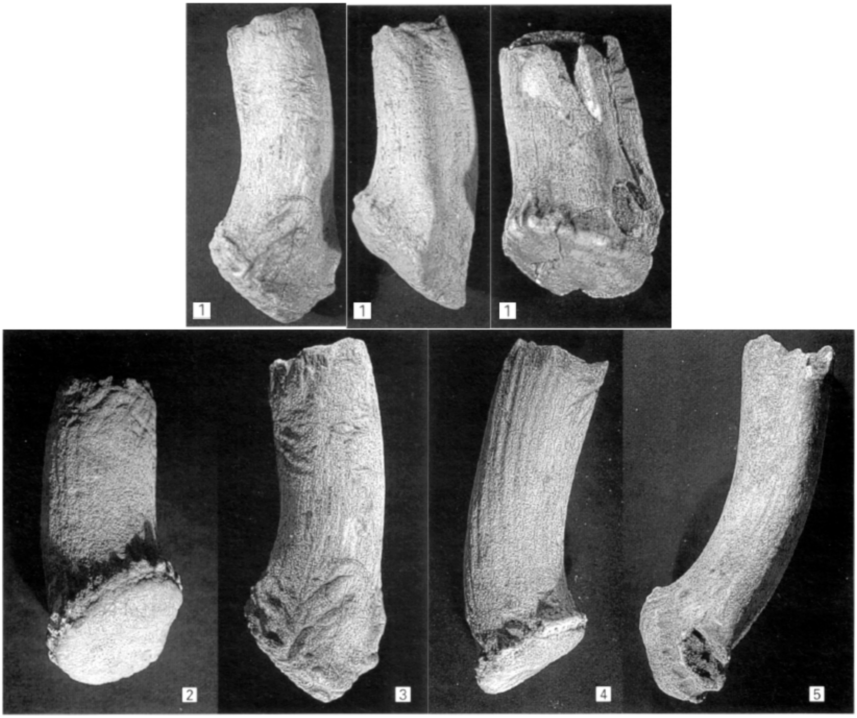

Figure 14.17 Possible strikers in Megaceros antler from the Upper IX Level of Labeko Koba.

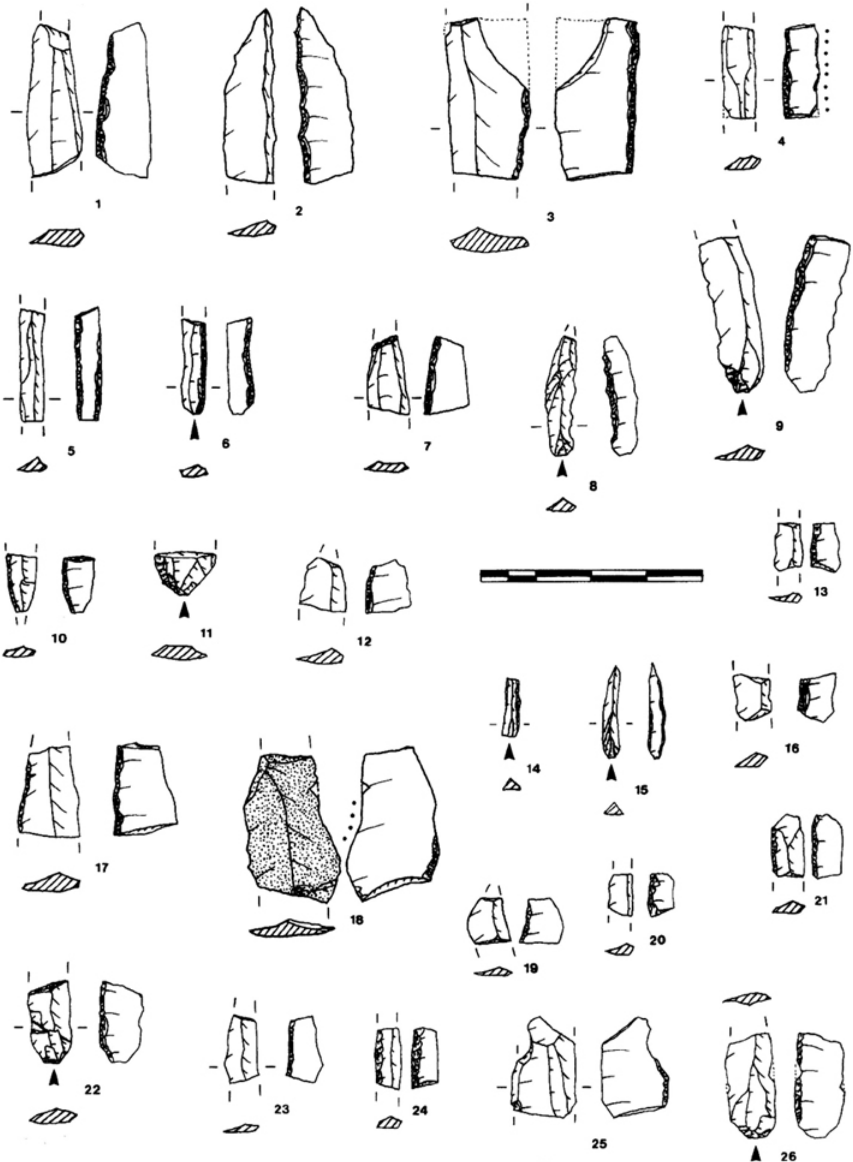
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Figure 14.18 Lithics from the VII Level (Protoaurignacian) of Labeko Koba.

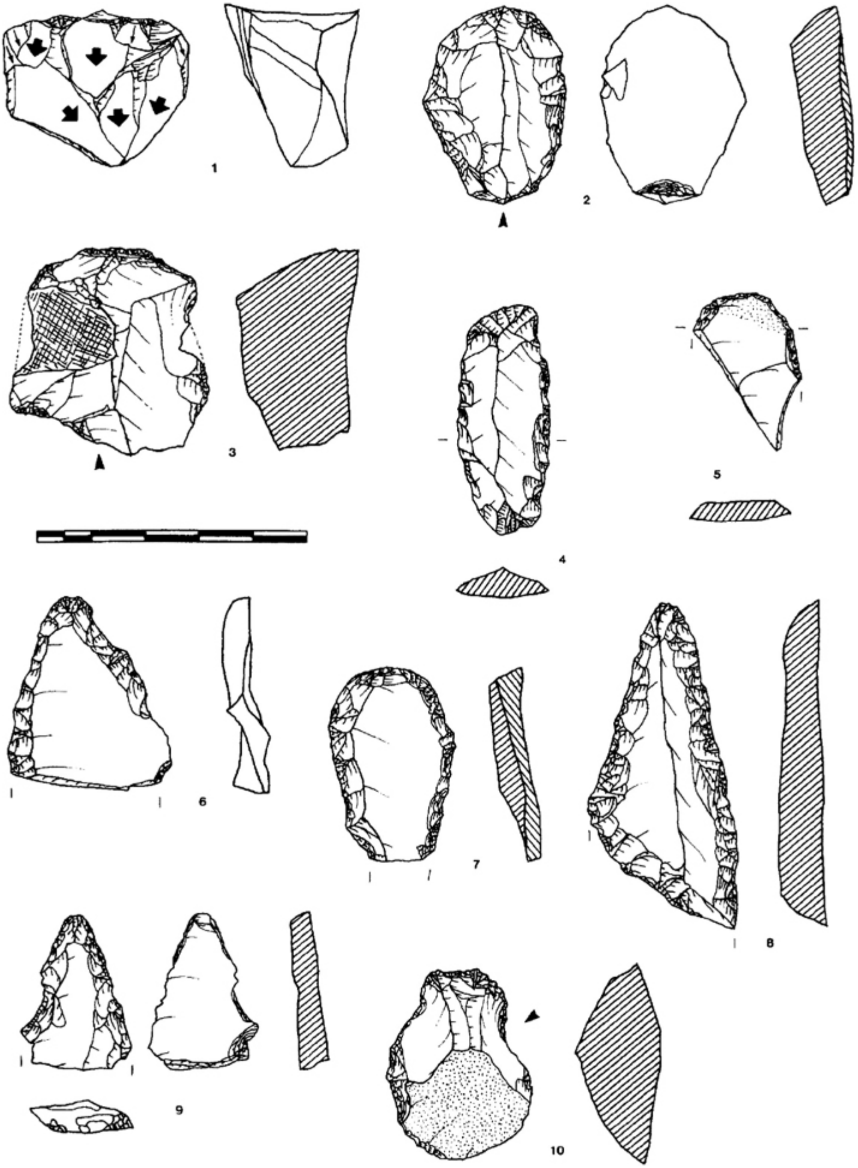
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Figure 14.19 Lithics from the Level V (Early Aurignacian) of Labeko Koba.

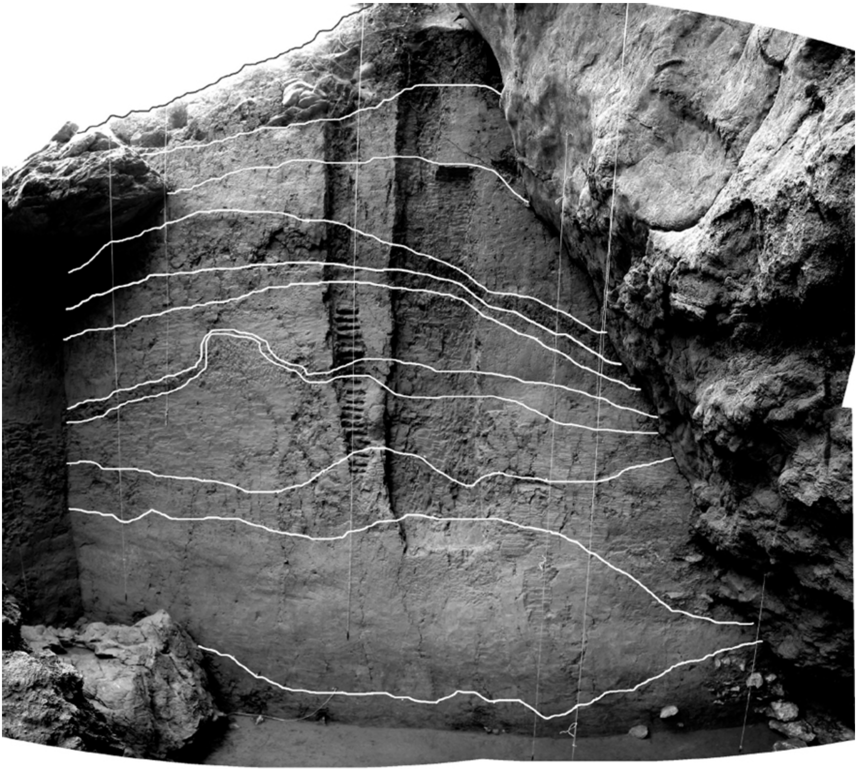


Figure 14.20 Stratigraphic profile of Lezetxiki (new excavations, since 1996).

In our opinion, what we have at Lezetxiki is a record of the transition between the Middle and the Upper Palaeolithic periods which is very rare and difficult to interpret, even more so in the absence of absolute dates (see a recent reference in Falguères *et al.*. 2005). In our opinion, the interpretation of these levels forces us to think in cultural and not just stratigraphic terms. Amongst the aspects which make the debate on the characterisation and study of these levels particularly interesting is the presence of Neandertal fossil remains at the base of level III, the appearance of malacological remains in levels III and IVc used as ornaments (Figure 14.21) and the simultaneous occurrence of Levallois and bladelet *chaînes opératoires*, at least in the units of level IV.

Isturitz (Saint-Martin-d'Arberoue, Pyrénées Atlantiques, France)

This enormous cavity (more than 2500 m^2), located some thirty kilometres from the current shoreline, in the foothills of the northern slopes of the Pyrenees at an altitude of 150 m, is part of a whole of three karstic galleries bored by a small river through a limestone hill. It includes two main parts, the Isturitz Hall and the Saint-Martin Hall, and was originally a large tunnel open at both ends. Excavations carried out there during the first half of the 20th century have brought to light extensive human occupations, which are, however, unequally shared between the sectors (Passemard 1944; Saint-Périer 1930, 1936, 1952). In fact, according to these authors, although the archaeo-stratigraphy in the Isturitz Hall covers the whole of the Upper Palaeolithic sequence, in the Saint-Martin Hall the anthropic evidence starts in the Mousterian (from bottom to top, layers P and M of the de Passemard excavations; S V and IV of the Saint-Périer excavations) continues to the Aurignacian (layers A and y of de Passemard; S III base, S III and S II of Saint-Périer) and then to the Middle Magdalenian (Passemard 1944; Saint-Périer 1930, 1936, 1952).

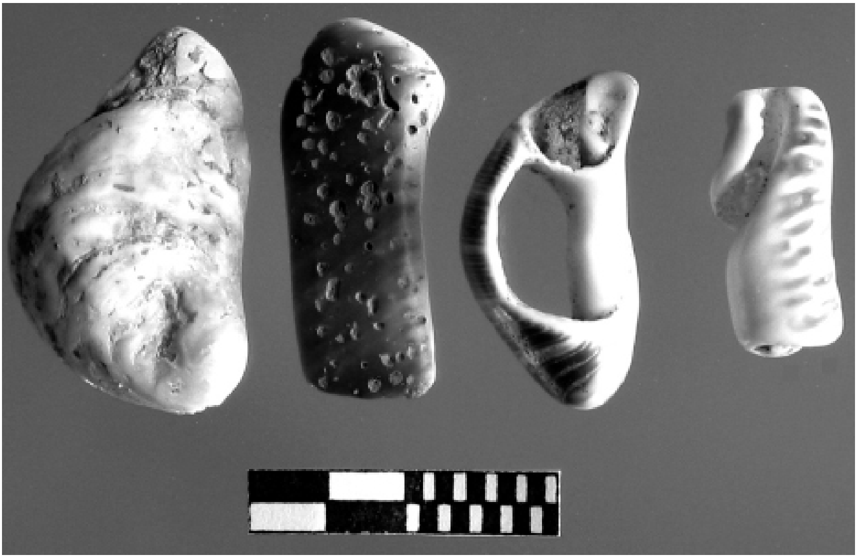


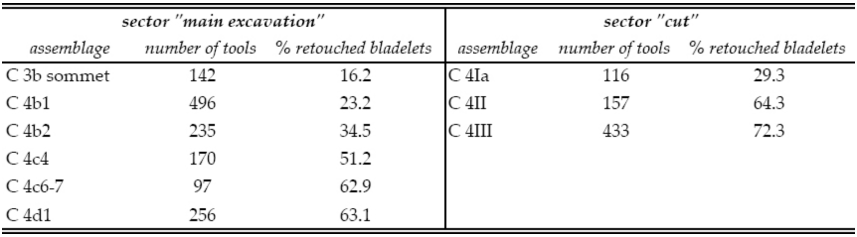
Figure 14.21 Malacological remains used as ornaments from Levels III and IVc of Lezetxiki.

Research has recently begun again in three forms: a diagnostic investigation carried out across the whole cavity between 1995 and 1998 (Normand and Turq in press) programmed excavation seasons, since 1999, in the Saint-Martin Hall, covering an area of over ten or so square metres and focussed on the Aurignacian sequence (Barandiaran 1999; Barandiaran *et al.* 2000; Normand *et al.* in press); and finally, new typo-technological studies of the Aurignacian lithic collections from former excavations to complete the already acquired information (Esparza 1995; Normand 2005–2006).

In the Saint-Martin Hall, excavations have revealed a complex stratigraphy with more than 15 archaeological assemblages, grouped into three series: lower, middle and upper. The first two, corresponding globally to A/S III, are very rich in artefacts and provide evidence for a strong human presence; the latter series (equivalent to y/S II), is considerably poorer and shows evidence for the progressive abandonment of the cavity by the Aurignacians, whose occupations of the site alternated with those of the large carnivores.

In this article we shall only address the current data regarding the bone and lithic industries from the nine levels having good archaeological reliability (six in the sector “main excavation” and three in the sector “cut”), with more complete details being given in other publications (Normand in press; Normand and Turq 2005, in press; Normand *et al.* in press); the data are obviously provisional given that the excavations have not yet been completed. In the first sector, only a few non-diagnostic elements have been collected in the lower and particularly upper series. On the other hand, the middle series has revealed more than 150 very varied objects, including several split-base spear points and elements linked to their manufacture. In the lithic industry, flint is the primary raw material (more than 97 %), with a supply coming mainly from within a radius of 25 to 40 km but sometimes exceeding 100 km (imports coming from the southern slopes of the Pyrenees and others, very rare, coming from the north of the Aquitaine region (Tarriño and Normand in press). As far as tools are concerned, the dominant artefact is the retouched blade, with percentages varying, from bottom to top, from more than 70 % to 16 % (Table 14.2).

Table 14.2 Diachronic evolution of laminarity in various levels from Isturitz.



sector "main excavation"			*sector "cut"*		
assemblage	*number of tools*	*% retouched bladelets*	*assemblage*	*number of tools*	*% retouched bladelets*
C 3b sommet	142	16.2	C 4Ia	116	29.3
C 4b1	496	23.2	C 4II	157	64.3
C 4b2	235	34.5	C 4III	433	72.3
C 4c4	170	51.2			
C 4c6-7	97	62.9			
C 4d1	256	63.1			

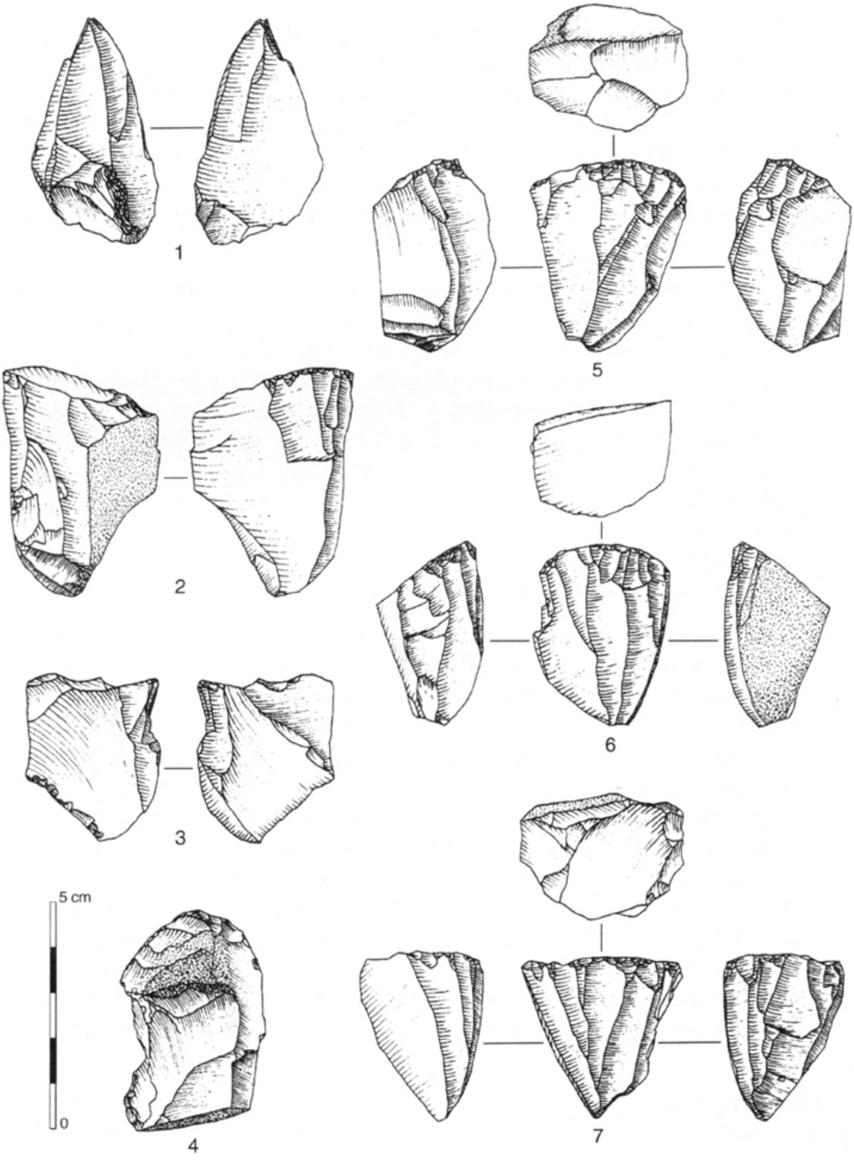


Figure 14.22 Isturitz cave. Some bladelet cores from the C 4d assemblage (Archaic Aurignacian): burin-shaped cores (1 to 3), carinated core (4), pyramidal cores (5 to 7).

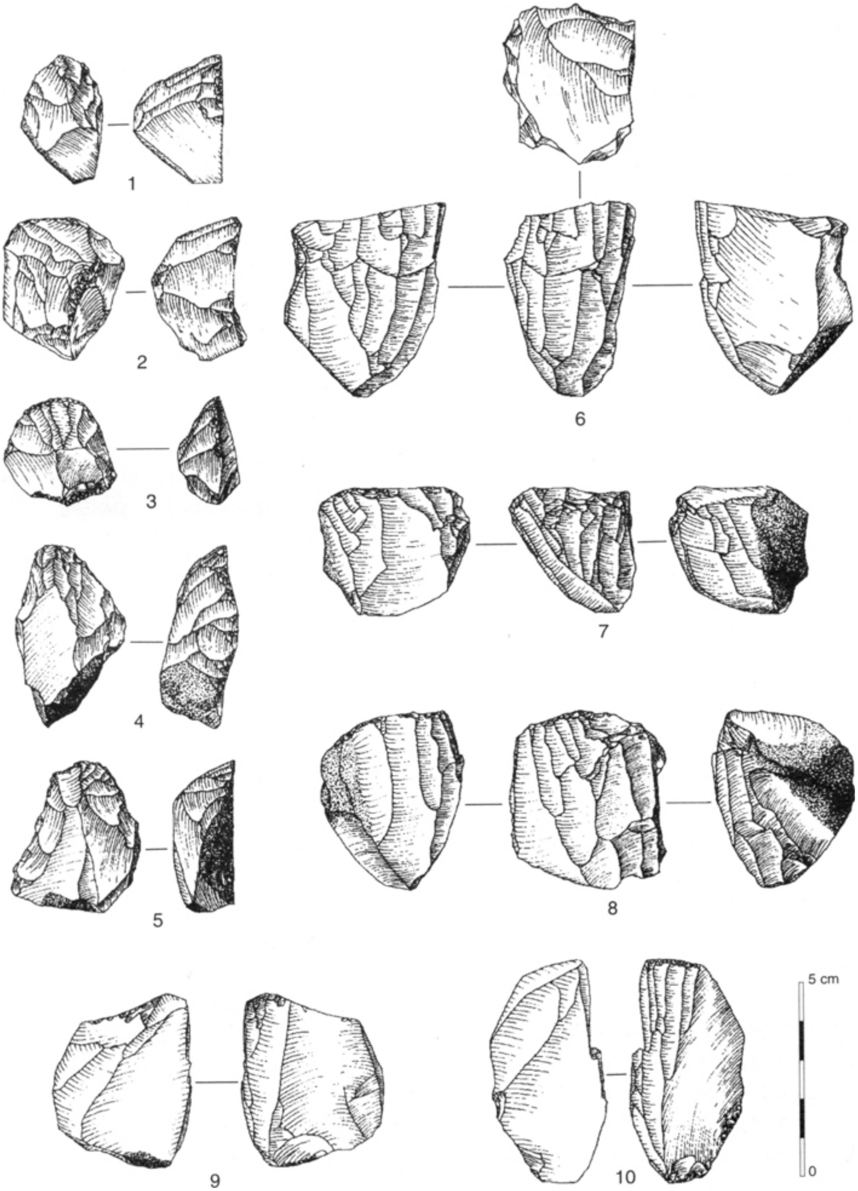


Figure 14.23 Isturitz cave. Some bladelet cores from the C 4b1 assemblage (Early Aurignacian): carinated cores (1 to 5), prismatic or pyramidal cores (6 to 8), burin-shaped cores (9 and 10).

Their production corresponds to four main types of cores: pyramidal, prismatic, flake cores and carinated (Figures 14.22 and 14.23). An evolution in the role of each of them appears quite clearly in all the levels of the two excavated sectors: while the first three are clearly dominant at the base of the sequence, it is the carinated pieces which are in the clear majority at the top. The morphology of the bladelets confirms this observation; in particular, while the pieces are almost always rectilinear in the lower series, the proportion of curved bladelets increases, notably in the middle series and even more so at the top; at the same time, the twisted character develops, while still remaining marginal. Two other variations should be noted: at the base of the sequence, burins are slightly more numerous than end-scrapers (5 % compared to 4.5 %), but the proportion of the latter subsequently increases (20 %) while that of the burins remains stable; within the retouched blades (from 15 % to almost 30%), the percentage of Aurignacian blades, which are very rare at the base (less than 1 %), increases quite notably (5.5 %). This fact goes hand-in-hand with the morphology of the blades, whose robustness becomes progressively greater and whose production becomes separate from that of the bladelets.

Together with these issues and re-evaluation of previously excavated collections, this information leads us to attribute the lower series to the Archaic Aurignacian, and the top of the upper assemblage to the recent phase of this techno-complex, which agrees with the dates obtained for the base and the top of the lower series and for the top part of the upper series (Table 14.1; Barandiaran 1999; Barandiaran *et al.* 2000; Turq *et al.* 1999). The middle series might represent a local *facies* of the Early Aurignacian.

Gatzarria (Suhare, Pyrénées Atlantiques, France)

Dug out of the foot of the southeastern slope of the large limestone massif of Arbailles (maximum altitude: 1268 m), this cave offers almost 50 m^2 of interior surface area. After the discovery in 1950 of prehistoric remains by M. Bouillon and P. Boucher and the carrying out of a survey by the latter in 1951, it was excavated between 1961 and 1976 by G. Laplace. The latter's research revealed a remarkable stratigraphy with, from bottom to top (Laplace 1966; Laplace and Sáenz de Buruaga 2002; Sáenz de Buruaga 1991):

- three Mousterian layers (Cr, Cjr and Cj). The lithic tools, made from flakes, in a variety of materials (flint, quartz, ophite, lydite, etc.) all exclusively local, include side-scrapers, denticulates, etc. together with cleavers in Cjr;
- a Chatelperronian layer (Cjn3). In the lithic series, production is more oriented towards obtaining blades, but production of flakes remains frequent as well. This is accompanied by a sharp increase in the supply of flint, though without excluding other materials such as quartzite which is still present in tools and represents some 9 %. The latter includes 225 pieces, including 13 Chatelperronian points and a high percentage of substrate elements (side-scrapers, denticulates, etc.). The bone industry is limited to a very small batch of "retouching tools"; personal ornaments are completely absent;
- four Aurignacian layers (Cjn2, Cjn1, Cbci-Cbf and Cb). The first two are attributed to the Protoaurignacian, the third to the Early Aurignacian and the last to the Evolved Aurignacian. In general, the blade-bladelet blanks form the great majority, made exclusively with flint from an unspecified origin, and they are associated with tools which are often very abundant (numbering between 93, for Cbci-Cbf, and 1525, for Cb) and diversified. There is a clear typological break between Cjn2 and the other 3 layers: the percentage of retouched bladelets and burins decreases over time (respectively: more than 25 % for

Cjn2, less than 15 % for Cjn1; 15 % for Cjn2, 12 % for Cjn1), while the proportion of end-scrapers increases substantially (4 % for Cjn2, 31 % for Cjn1). On a technological level, this change appears less evident, in particular in the area of bladelet production, where carinated cores seem to play a predominant role in all the layers. Apart from several dozen "retouching tools", smoothing tools, etc., the bone industry includes numerous points, very often incomplete, including 2 fusiform-shaped fragments (Cjn2) and quite a number of examples with a split base (Cbci-Cbf). The development of personal ornaments takes on a varied range with a prevalence of basket-shaped beads, in ivory or in steatite, and perforated fox teeth;

- finally, a Gravettian layer (Cbcs), which is relatively poor in artefacts.

Brassempouy (Landes, France)

This is one of the very few cave sites in Chalosse, situated in the Eocene limestone outcrops of the S-E diapir of Bastennes-Gaujacq, at an altitude of 50 metres. The site is formed of three rock-shelters, all of which have provided archaeological remains in a stratigraphy of reference for the Upper Palaeolithic of the region: Grotte des Hyènes and Abri Dubalen (Chatelperronian, Archaic Aurignacian, Early Aurignacian) and Grotte du Pape (Chatelperronian, Aurignacian *sensu lato*, Gravettian, Solutrean, Magdalenian) (Bon *et al.* 1998; Buisson 1996; Henry-Gambier and Bon in press; Henry-Gambier *et al.* 2004a).

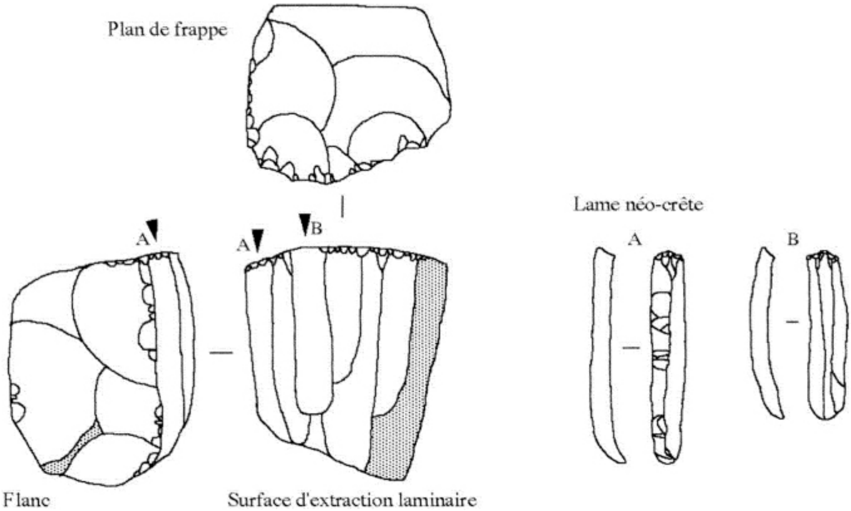


Figure 14.24 Brassempouy (Landes, France), Grotte des Hyènes: Reconstruction of a blade production sequence (Early Aurignacian)

The site was discovered in 1880, when the first archaeological remains were found during the construction of an access road for the nearby quarries. Since then, numerous interventions have been carried out there. The first were carried out by P-E. Dubalen who discovered the caves of Hyènes and Pape, with the latter being excavated (Dubalen 1881). Later on, J. de Laporterie and A. Léon-Dufour also excavated Pape (Laporterie 1892). The former, accompanied by E. Piette, carried out fieldwork seasons between 1894 and 1897, discovering, amongst other findings, the famous *Dame à la capuche* (Piette and Laporterie 1894, 1897, 1898; Piette 1896). H. Breuil later used the results of these excavations to defend the hypothesis of the anteriority of the Aurignacian, between the Mousterian and the Solutrean (Breuil 1905, 1907, 1909). Both the materials and the site were forgotten until H. Delporte carried out a review of them (Delporte 1967). In 1981, this researcher restarted the excavations of the site to clarify more specifically the stratigraphy of the former excavations and excavate in the intact part of the cavity. Later operations were directed by D. Buisson (1995–1996) and D. Henry-Gambier (1997–2004).

In this article we are focussing on the site of Hyènes, specifically levels 2A, 2F and 2DE, all of which are classified as Early Aurignacian (see Bon 2002; Bon *et al.* in press; O'Farrell 2005, for descriptions of the lithic industries and context of these levels) (Figures 14.24, 14.25, 14.26 and 14.27). These levels display intensive anthropic occupation. In addition to large and plentiful faunal remains (Letourneux 2005), a bone industry (Tartar 2003), plentiful ornaments and decorated pieces are also quite prevalent (Henry-Gambier and White 2006; White 1996). Particularly noteworthy are the many split-base points, smoothing tools, awls, chisels, etc., amongst the bone industry pieces (Pétillon and Tartar in Henry-Gambier and Bon in press; Tartar 2003). Beads made of various raw materials and necklaces of shell are some of the personal ornaments present (Gardère in Henry-Gambier and Bon in press; White 1996). The human remains are not very abundant (some dental remains and few bone fragments) and are of little use in diagnosis, their affiliation with *Homo sapiens sapiens* being discussed elsewhere (Henry-Gambier *et al.* 2004b). The chronology spans the range from 31 000 to 34 000 B.P. for the Early Aurignacian levels, covering the Archaic Aurignacian and, on the basis of the sequence, the Chatelperronian, dated to around 36 000 B.P. (Bon *et al.* 1998; Buisson 1996; Fontugne in Henry-Gambier and Bon in press; Henry-Gambier *et al.* 2004a).

Current research avenues for some key questions

We shall now take a brief look at the present state of affairs in the geographical area between El Castillo Cave and Brassempouy. We shall then give some thought to the difficulties of connecting all this information, in a geographical region which is relatively small, but very representative of the complicated issues evoked by the transition from the Middle to the Upper Palaeolithic.

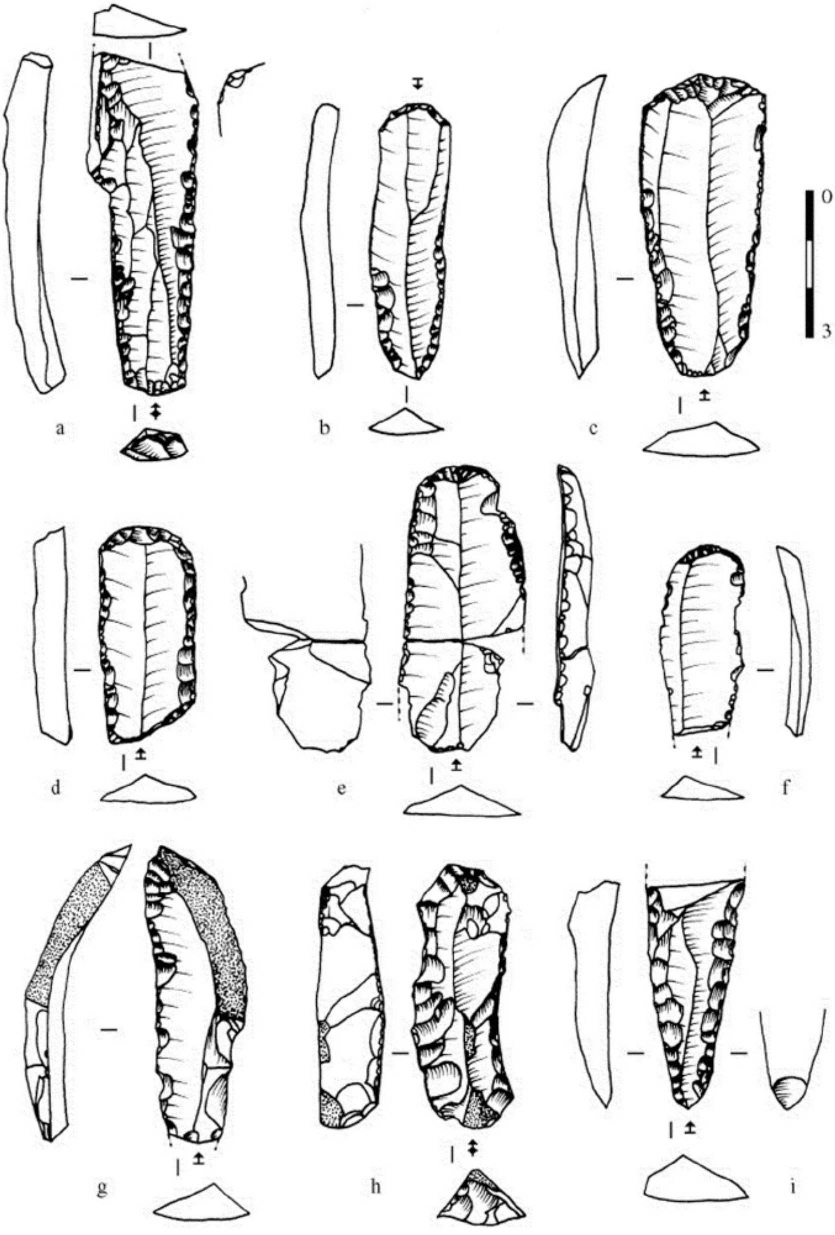


Figure 14.25 Brassempouy (Landes, France), Grotte des Hyènes: end-scrapers and retouched blade (Early Aurignacian; a-d: level 2F; e-i: level 2A).

Chronology

Dealing with the chronology of the Transition from the Middle to the Upper Palaeolithic is a task whose results have to be taken with caution. First of all, there is the limitation of the dating method itself, generally radiocarbon, which is presently only reliable back to a certain point. Secondly, there are issues of an archaeological nature, such as where do we set the limit of the final Mousterian? Or, at what exact point do we place the first evidence of the Upper Palaeolithic? Without doubt, all of this, together with the very idiosyncratic nature of this period (the Transition) complicates the field of study tremendously.

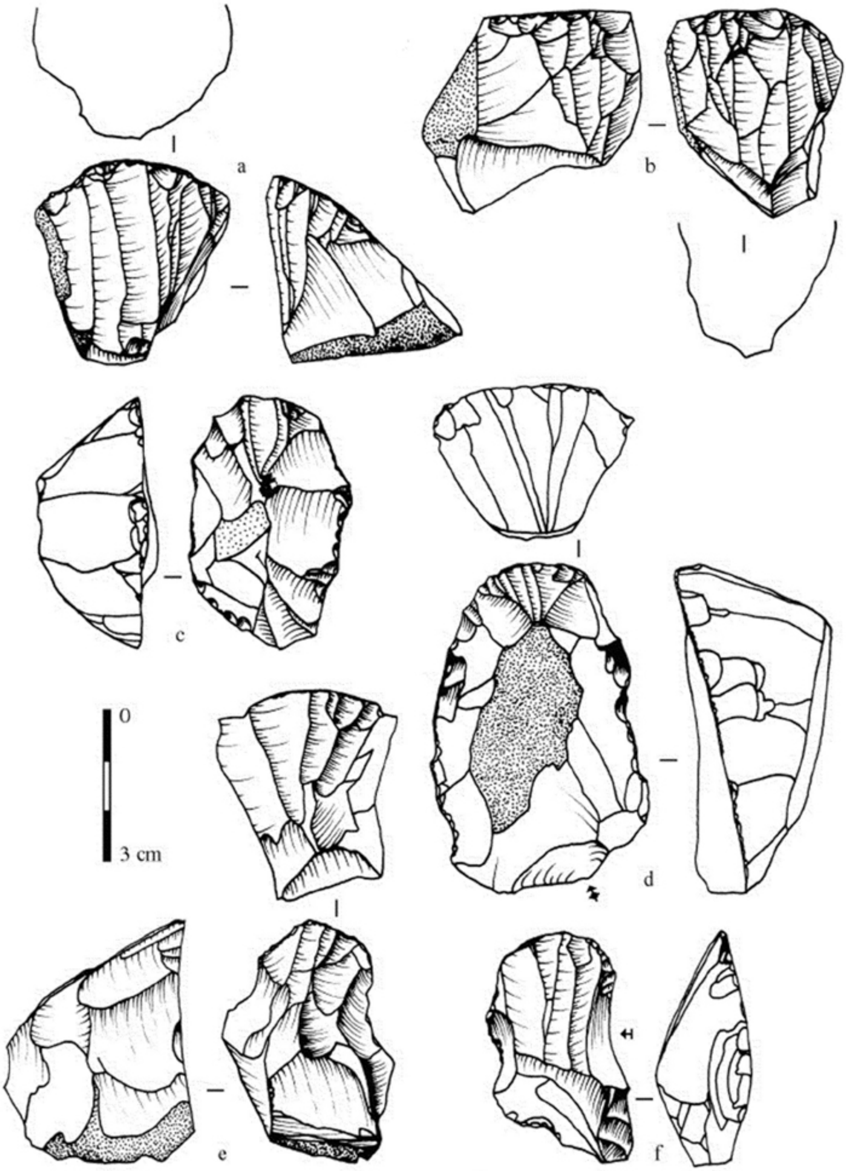


Figure 14.26 Brassempouy (Landes, France), Grotte des Hyènes: Carinated cores (Early Aurignacian; a-b: level 2DE; c-f: level 2A).

We have placed the end of the Mousterian at around 50–39 000 B.P. from the results obtained at El Castillo and Cueva Morín (Cabrera *et al.* 1996b; Maíllo *et al.* 2001), although there are sites whose dates are considerably more recent, such as at El Esquilleu (Baena *et al.* 2005, 2006). Overlapping with the final Mousterian we find, on the one hand, the Transitional Aurignacian, dated at 40 000 B.P. for level 18c and 38 500 B.P. for 18b at El Castillo (Cabrera and Bischoff 1989; Cabrera *et al.* 1996b; Rink *et al.* 1997) and the Chatelperronian, which is stratigraphically below the Archaic Aurignacian at Cueva Morín and Labeko Koba, although, in the latter, the radiocarbon date is very recent: 34 215 ± 1265 B.P. (Ua-3324). The dates for the Archaic Aurignacian in the Basque-Cantabrian area begin around 36 500 B.P. in sites such as La Viña in Asturias (Fortea 1995), Cueva Morín, El Castillo, Labeko Koba and Isturitz (Arrizabalaga 2000; Cabrera *et al.* 2002; Maíllo *et al.* 2001; Normand and Turq 2005), extending to 30 000 B.P.

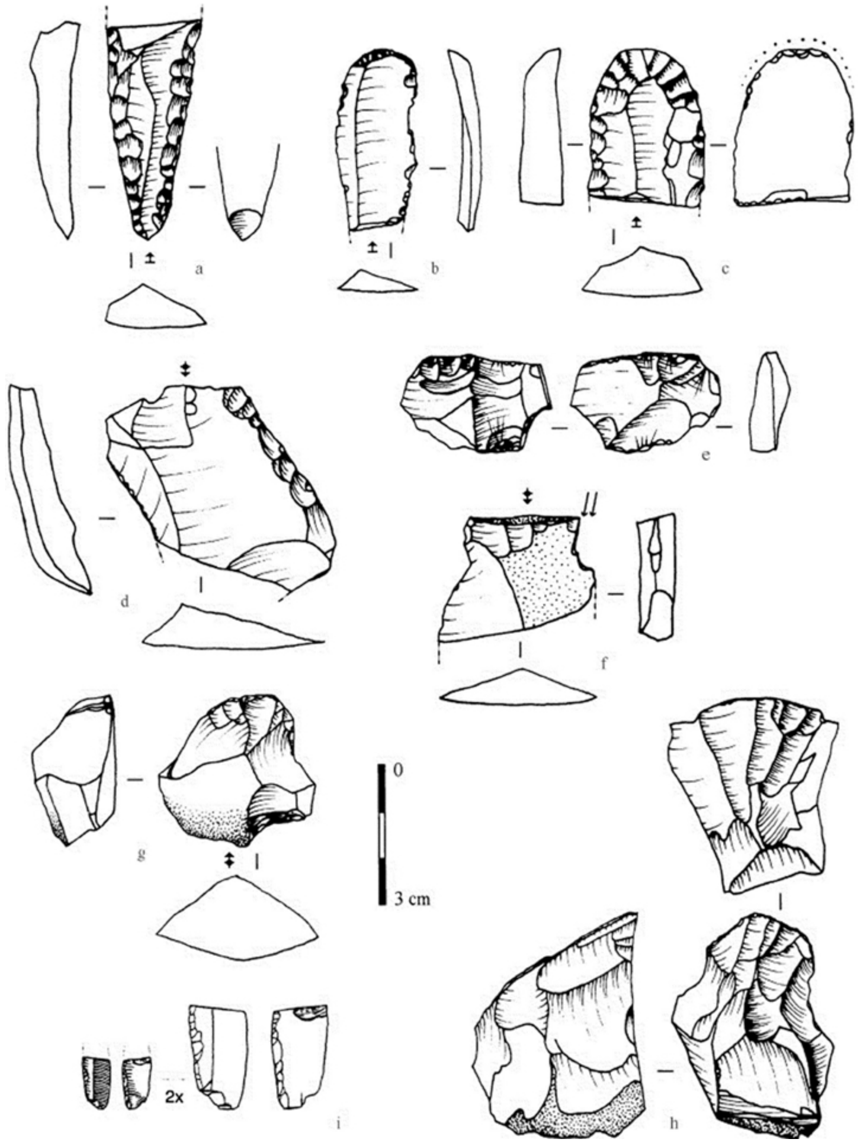


Figure 14.27 Brassempouy (Landes, France), Grotte des Hyènes, level 2A (Early Aurignacian). a-c. end-scrapers and retouched blade; d. side-scraper; e. splintered piece; f. burin; g. nosed end-scraper (core?); h. carinated core; i. Dufour bladelet (after O'Farrell 2005).

Hence, reviewing the radiometric dates for the Transition, we can see that there is a certain overlap, for example between the Chatelperronian of Labeko Koba and the Archaic Aurignacian of Cueva Morín. This fact may be due to two causes: one cultural and the other physical. The cultural one relates to the possibility that different technocomplexes were contemporaneous in this region during this time interval, leaving us unable to evaluate fully the relationship between them. We will not go into an assessment of the human type responsible for each of the technocomplexes outlined here, especially given that the evidence from the fossil record does not allow complete assessment of this. The physical cause for the apparent chronological overlap of the industries, if it was a factor, is due to the very nature of the radiometric dating methods. Radiocarbon dating is at the limit of its use in this period, with guarantees of its correlation with other methods (TL, ESR, in particular) not being yet clear. Hence, the possibility exists that the situation which we have described corresponds to nothing more than a mirage caused by the very different methods used and their results (Cabrera *et al.* 2004a).

Another very interesting aspect provided by this period is the chronology of the Archaic and Early Aurignacian in this region. Stratigraphically, the Early Aurignacian is superimposed on the Archaic Aurignacian (see Figures 14.2, 14.10 and 14.15) in the entire region outlined here (Arrizabalaga *et al.* in press); the radiocarbon dates also corroborate this fact, but show a partial synchrony of both technocomplexes in the region, not within a site, but between sites. This problem, which could have the same causes as those we have described in the previous paragraph, must also be analysed from a perspective of territorial occupation which, necessarily, must exceed the regional framework dealt with here (Bon *et al.* 2006). As we have already mentioned, the makers of the Archaic Aurignacian settled in the Basque-Cantabrian region around 36 500 B.P. exhibiting techno-typological characteristics very different from those of the Early Aurignacian, whose first manifestations in this region are at the site of Brassempouy with a date for level 2DE of 33 600 ± 240 (Gif-11034). The overlap of dates in this region might imply a partial coexistence of both techno-complexes. This coexistence would not have taken place in the same territory, but in adjacent regions, as the techno-complexes do not coincide in terms of geographical space. Whether or not there exist assemblages attributed to the Archaic Aurignacian which last beyond 34 000 BP, there are two aspects in particular regarding the Archaic Aurignacian which should be retained: firstly, the Early Aurignacian does, definitely, seem to be rooted in the Archaic Aurignacian; secondly, the evolution from one to the other seems to have taken place in western Europe (Teyssandier 2007). Thus, in terms of the theme of the Middle to Upper Palaeolithic transition, one of the key issues is the position of the Archaic Aurignacian and the conditions of its development in Europe.

Palaeoenvironment

The largest amount of information available about the palaeoenvironment during the transition from the Middle to the Upper Palaeolithic comes from studies of palaeontology, sedimentology and palaeobotany. These analyses have been applied to archaeological deposits (generally in karstic environments), although palaeobotany is now taking on board palynological studies of deposits of non-anthropic origin. The palaeoenvironmental information from this period corresponds to a succession of individual moments, which, in none of the cases allows us to establish a continuous view, either in terms of the chronological development, or in terms of the various bio-geographical environments which characterise the area with which we are dealing. Various factors are responsible for this situation: the scarcity of deposits having continuous stratigraphic sequences; the existence of sedimentary and/or pollen hiatuses; problems of conservation of the organic material; the absence of limnetic deposits in certain areas of the Cantabrian and Atlantic coasts; application of the principle of geological sampling in palaeopalynological studies etc.; on occasion, the combination of several of these factors restricts even further the information available.

The bio-geographical variability of this area allows for the existence of a diversity of environmental areas which would have provided an interesting variety of resources in terms of both fauna and flora for the human population. The information regarding fauna (see the section on hunting economy below) is greater than that of the plant world, but both of them, as with that from sedimentology studies, reflect the development of various climatic episodes (for further details see: for El Castillo: Dari 2003; Morín: González-Echegaray and Freeman 1971, 1978; Kurtzia: Muñoz *et al.* 1989–1990; Arrillor: Hoyos *et al.* 1999; Labeko Koba: Arrizabalaga and Altuna 2000; Lezetxiki: Altuna 1972, Chaline 1970, Kornprobst and Rat 1967, Sánchez-Goñi 1993; Ekain: Altuna and Merino 1984; Gatzarria: Lévêque and Miskovsky 1996; Isturitz: Bouchud 1951, 1952, Leroi-Gourhan 1959; Duruthy: Arambourou 1978; La Roche-à-Pierrot: Leroi-Gourhan 1984, Leroyer 1987; Biscaye: Mardones and Jalut 1983). During this period, there is evidence for the existence of a succession of landscapes with cold environments, characterised by a large majority of open landscapes with a dominance of herbaceous taxa (*Poaceae* or Grass family and *Compositae* or Composite family) together with a greater or lesser representation of steppe species (depending on the degree of humidity) in which we find animals such as *Mammuthus primigenius, Coelodonta antiquitatis, Rangifer tarandus*, etc. These environments contrast with those developed during the episodes of climatic improvement in which forest coverage increased, with a predominance of mesophyll tree species (*Quercus, Corylus, Alnus, Betula, Ulmus, Tilia, Castanea*, etc.) and a noted increase in fauna associated with wooded areas (Altuna 1992, 1994; Iriarte *et al.* 2005; Ramil-Rego *et al.* 2005). In general terms, it appears that the end of the Mousterian and the beginning of the Upper Palaeolithic (Chatelperronian) coincide with the final moments of the so-called Würmian Interstadial, under benign climatic conditions (Cueva Morín, Labeko Koba, La Roche-à-Pierrot, the Biscaye peat bog), a situation which becomes a climate dominated by adverse conditions during the oldest periods of the Aurignacian. This latter period corresponds, in the case of Labeko Koba, to the base of the Protoaurignacian level, while at the end of this technocomplex, the environmental conditions tended to improve, worsening again throughout the Early Aurignacian. As expected, a one-to-one relationship between the change in human species and climatic change does not exist.

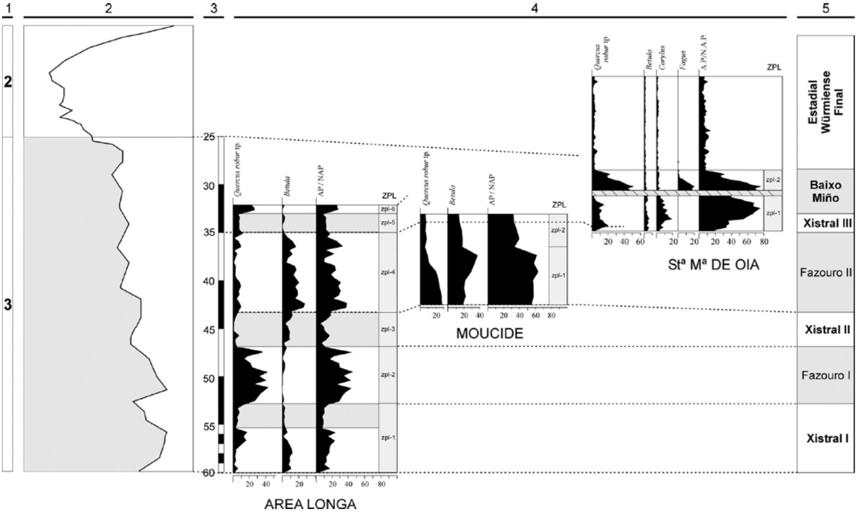


Figure 14.28 Correlation of arboreal expansion phases registered during OIS 3, in the main sequences obtained in the coastal territories of the NW of the Iberian Peninsula (Gómez-Orellana 2002): 1. Isotopic stages; 2. Curves of variation of normalized O18 (Martinsson et al. 1987); 3. Chronology; 4. Biostratigraphical Periodisation of OIS 3 in the coastal territories of the Iberian NW.

Despite this limited amount of information, the snapshot views which we have recovered until now are coherent between the succession of phases of glacial progression and retreat of Isotopic Stage 3 of the isotopic sequences in the ice cores in Greenland (Dansgaard *et al.* 1993) and in Atlantic marine and European continental cores (Huntley *et al.* 2000, Jouzel *et al.* 1993, Tzedakis *et al.* 1997, Voelker and Workshop participants 2002). Similarly, data recovered from limnetic sequences of the coastal and sub-coastal areas of the northwest Cantabrian region (Figure 14.28) (Gómez-Orellana 2002; Muñoz-Sobrino 2001) indicate a high degree of environmental instability which would only allow moderate expansion of the forest mass in those territories where small populations were living in areas of shelter. The characteristics of this territory have allowed the existence of an interesting variety of bio-geographical units throughout the Quaternary, a circumstance which cannot be forgotten when trying to apply a unitary model to the entire region; hence, it is not appropriate to question those sequences which do not comply with it (Iriarte *et al.* 2005). The environmental evolution throughout the Upper Pleistocene was very diverse, as was the response that these bio-geographical areas had and what they could offer during the succession of climatic periods. In any case, in the near future, the amount of information will increase considerably due to the inclusion of the studies of new deposits (archaeological or not), and the review of some of those mentioned in this work, such as Lezetxiki and Isturitz.

Table 14.3 Ungulates in the main Cantabrian levels of the Mousterian and Initial Upper Palaeolithic. CST representes El Castillo; MO represents Cueva Morín.

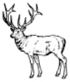
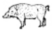
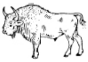
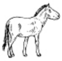
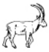
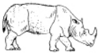
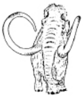
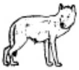
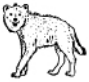
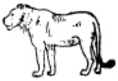
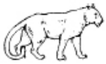
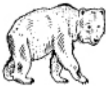
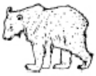
									
CST 18b	172	10	4	10	6	2	29	5	1
CST 18c	125	7		10	4	3	13	5	
CST 20ab	13	1		6	7	2	1	3	
CST 20c	37	4		12	14		6	5	
CST 20d	15	2		12	16		3	6	
CST 20e	17	2		9	14	2	2	4	
MO 6	7	6		5	4	1			
MO 7	7	2		2	1				
MO 8	3	2	1	2	4				
MO 9				1	2				
MO 12						1			
MO 15	1	2		1	1				
MO 16	1			1	1				
MO 17	8	3	1	10	11	1			
MO 22				2	1			1	

Table 14.4 Carnivores in the main Cantabrian levels of the Mousterian and Initial Upper Palaeolithic. CST representes El Castillo; MO represents Cueva Morín.

						
CST 18b	1	2				6
CST 18c	2		1	1		1
CST 20c					1	
CST 20e					1	
MO 17	1	2				

Hunting strategies

The known location of the sites in the Mousterian and the Initial Upper Palaeolithic appear to show a certain continuity, being located along the narrow coastal strip of the Cantabrian Sea, occupying both the area of low hills of the Cantabria Marina, as well as the edges of the Cantabrian mountain range. The location of the Mousterian sites is, for the most part, in the wide valleys of the low altitude mountainous regions (Cabrera *et al.* 2004b) although the presence of deposits along the rivers in the inland valleys, with abrupt areas but with heights of between 100 and 300 metres, suggest to us more specialised subsistence strategies such as ibex hunting.

If we compare the Cantabrian region with other nearby areas, such as that of the Pyrenees, we observe an important phenomenon. Geographically, the Cantabrian Region is a corridor with a direction of mobility which is mainly east-west, while the Pyrenees are located in areas with possibilities of expansion in other directions. In the case of the Pyrenees, we can detect, together with an east-west direction, another which is south-north (Bahn 1984). On the one hand, we find a Mediterranean-Atlantic relationship together with another link, the Pyrenees-Dordogne one. In the case of the Cantabrian Region, the fundamental axis is The Basque Country-Asturias due to the fact that during low sea levels, the Cantabrian coast was narrower and more marshy than the Aquitaine one. Communication with the south, both via the Ebro valley and the Duero valley, are possibilities which are known but for the moment not frequently propounded (Tarriño and Normand 2002).

As in the other periods of the Upper Palaeolithic, it is the land biotopes which are most used, although differing depending on the variety of the environment of sites. Marine resources were used, but without the intensity which is seen in other periods, such as the Magdalenian. The principal faunal assemblage remains in Cantabria related to the problems of the transition come from Cueva Morín (Altuna 1971, 1972, 1973), El Castillo (Dari 2003), Ekain (Altuna and Mariezkurrena 1984), Lezetxiki (Altuna 1972) and Labeko Koba (Altuna and Mariezkurrena 2000) sites. What we are interested in finding out at present is the cynegetic pressure on the groups which occupied these sites and their ability to obtain these key resources. The details are shown in Table 14.3 for the main ungulates of the Mousterian and Initial Upper Palaeolithic, and in Table 14.4 for the carnivores. The comparison between sites shows, first of all, the existence of clear differences in the quantity of game present, as well as the progressive importance of deer in the transition. The spectrum of species present at the sites reflects the diversity of habitats accessible and the availability of resources for the human groups which lived in the area. It is also important to note the scarce representation of carnivores and scavengers, which gives us an indication of the intensity and integrity of the occupation.

The results of the season of occupation analyses of the caves of El Castillo and Morín can be seen in light of the character of the sites. El Castillo and Cueva Morín are situated one day's walk away from resources on the coast, in rivers, valleys, forests and mountains. None of the caves shows dramatic differences between subsistence practices in the Mousterian and the beginning of the Upper Palaeolithic, nor with regard to the use of the site in terms of season of hunting and age of the individual prey animals (Pike-Tay *et al.* 1999). Nevertheless, each site exhibits its own pattern which reflects choices of behaviour by the Mousterian occupants and those of the initial Upper Palaeolithic. The results of the analyses of tooth cementum carried out by A. Pike-Tay (Pike-Tay *et al.* 1999) at El Castillo suggest annual capture, both throughout the Mousterian and the Transitional Aurignacian. In spite of this, the seasonal patterns of the Mousterian assemblages differ somewhat from the upper unit asemblages. The majority of the animals were hunted from the end of autumn to the spring or early summer in the Mousterian levels and from winter to spring in the Transitional Aurignacian. At Cueva Morín the results of these analyses suggest that the animals were hunted during the late autumn and/or winter during the Mousterian and the Early Aurignacian. The changes in the seasonal hunting patterns and in the duration and nature of the occupations of these sites undoubtedly reflect changes in the patterns of land use, technological innovations and strategies for collecting resources which are at the same time a response to climatic fluctuations and to changes in the regional population dynamics.

Examining the quantities of faunal remains represented at each site (see Tables 14.3 and 14.4), and calculating the amount of meat they represent, we can see (Bernaldo de Quirós 1982) that the amount is limited. We can also observe a certain distinction between levels, a few containing a large quantity and many having only a little. This allows us to propose certain dichotomies between the sites, with some of them used by the group in general, and others occupied by only a segment of the same. This dichotomy is also present in some sites with specialised hunting, with examples like El Esquilleu (Yravedra 2005), specialised in ibex hunting. Sites which were specialised in hunting deer are also found at this time, such as the cave of El Castillo, in which there is a large number of deer, as confirmed by recent excavations (Cabrera 1984; Dari 2003). We can thus identify aggregation sites, which are generally large in area, rich in industry and animal remains (generally deer) such as Castillo, and other satellite sites, occupied by some individuals, with less typological variability and in which the faunal remains show balanced quantities of deer and other animals. In this category we could include Morín, Lezetxiki, Labeko Koba and El Otero, together with very ephemeral occupations (Ekain). The third group is the one we have already mentioned, sites specialising in ibex hunting such as Rascaño and El Esquilleu. Thus we can see that the sites are located in a territory in which we can observe intelligent management of the resources both during the Mousterian and the Initial Upper Palaeolithic, which brings a new element to the discussion of the “Transition” (Pike-Tay *et al.* 1999).

The lithic technology of the Archaic Aurignacian and the Early Aurignacian

The study of the lithic production schemes of the archaeological assemblages dealt with here allows us to give a more complete view than the one provided by traditional typological studies, as it allows us to recognise a variety of traditions within the different industrial assemblages belonging to the first phases of the Upper Palaeolithic in the Cantabria-Pyrenees region. These differences of ‘tradition’ are not only noticeable between the two *facies* dealt with in this work, but also within them (Arrizabalaga *et al.* in press; Bon 2002; Bon *et al.* 2006). In terms of their technological characterisation we shall focus on the production schemes of the blades which we consider to be of greater qualitative weight when it comes to carrying out characterisation and industrial comparison.

Protoaurignacian / Archaic Aurignacian (Figure 14.13)

The sites which allow technological identification of this technocomplex are: Cueva Morín (levels 8 and 9); El Castillo (level 16), Covalejos (level A), Labeko Koba (level VII), Gatzarria (Cjn1; Cjn2) and Isturitz (level C4d) from which we can identify the following aspects regarding lithic production (Arrizabalaga 1995, 2000; Cabrera *et al.* 2002; Laplace 1966; Maíllo 2002/2003, 2003; Ortega 2004; Normand 2002; Normand and Turq 2005; Sáenz de Buruaga 1991):

a) There was a *continuum* between the production of blades and bladelets.
b) The most common method used was that carried out from unipolar prismatic cores.
c) The *mise en forme* was simple, and there was prior morphometric adaptation of the volume. The beginning of the debitage could be done due to *entame* or crests which opened the surface of *débitage* or table. The striking platforms were prepared and resharpened during the debitage process by means of the extraction of core tablets, with these being smooth and slightly oblique compared to the percussion plane. The process was carried out by direct percussion using a soft hammer.

d) Two types of blanks were obtained: blades and bladelets with a straight profile which were very regular, would be obtained from the centre of the table; the blades and bladelets with a more curved profile, particularly those coming from the distal part with lateral cortex (which may be substituted by neo-crests), would be obtained at the intersection of the table and the flank. The aim of these extractions was to control the *cintrage* of the table in order to create volumetric conditions of the core necessary for the creation of the first type of blanks.

f) The bladelets were used to make *Dufour* bladelets, sub-type *Dufour* (Demars and Laurent 1989).

g) Other production schemes, such as the extraction of bladelets from carinated cores and carinated burins, are present, although their importance in bladelet production is relative.

h) On some sites (Gatzarria and Cueva Morín), of particular note is the fact that the debitage of some blanks is by discoidal reduction schemes, reflected amongst the retouched material, where pieces from a common base are very abundant.

Early Aurignacian (Figure 14.14)

There is a greater number of levels classified as Early Aurignacian in the zone of study. Here we shall deal with the most significant of these which are: Cueva Morín (levels 7 and 6), Labeko Koba (levels VII, VI and V), Gatzarria (Cbci-Cbf) and Brassempouy (levels 2A, 2F and 2DE) (Arrizabalaga 1995, 2000; Bon 2002; Cabrera *et al.* 2004a; Laplace 1966; Sáenz de Buruaga 1991):

a) The most relevant technological feature of this technocomplex is that there is a dissociation between the production of blades and that of bladelets. The former was carried out from unipolar prismatic cores, while the latter was performed using production schemes of a carinated end-scraper type. This dissociation, between one production and the other, is found in all aspects we studied: the dynamic and architecture of the *debitage* is radically opposed, as are the blanks used to carry them out. Furthermore, the blanks obtained have opposing technical characteristics, and this is true even for the reviving methods.

b) Of note is the fact that the production of blades is systematised on all the sites. The prismatic morphology and the unipolar management were the most important elements, but the convergences can be seen more clearly in other, more specific, spheres:

- The blanks obtained were blades of a certain robustness (of varying length depending on the regional raw materials), with a certain curvature, particularly in their distal part.
- The ways in which the butts were prepared is also significant: faceted or *éperon*, both related to the use of direct percussion with a soft hammer for the northern Pyrenees area, while on the Cantabrian coast the percussion planes are flat.
- The reconditioning of the appropriate technical conditions for *cintrage* and carinate forming of the core were usually achieved by the creation of neo-crests in the join between the table and one of the flanks. Also significant, though not common, was the use of a second striking platform to rectify possible accidents during the *débitage*.
- The method of starting the process was usually identical: *entame* flakes or blades

or starting blades and laminar semi-cortical blanks until the table was shaped.

c) The production of bladelets was more homogeneous as far as methods and means used to carry it out are concerned.

- The blanks used were carinated cores, with flakes or small blocks, some with fractures in *splitz* (for example at Brassempouy). In short, there is an adaptation of the blanks to the type of operation to be carried out.
- The table was usually triangular in shape.
- The shaping of the cores was carried out using a basal crest and lateral notches or crests, the latter of which were revived during the process.

	11	10	9	8b	8a	7	6	5b	4
Laminar blanks	7.8	24.1	24.6	35.4	38.2	41.2	34.1	48.6	42.7
Flakes	92.2	75.9	75.4	64.6	61.8	58.8	65.9	51.4	57.3

Figure 14.29 Diachronic progresion of laminarity in some levels from Cueva Morín.

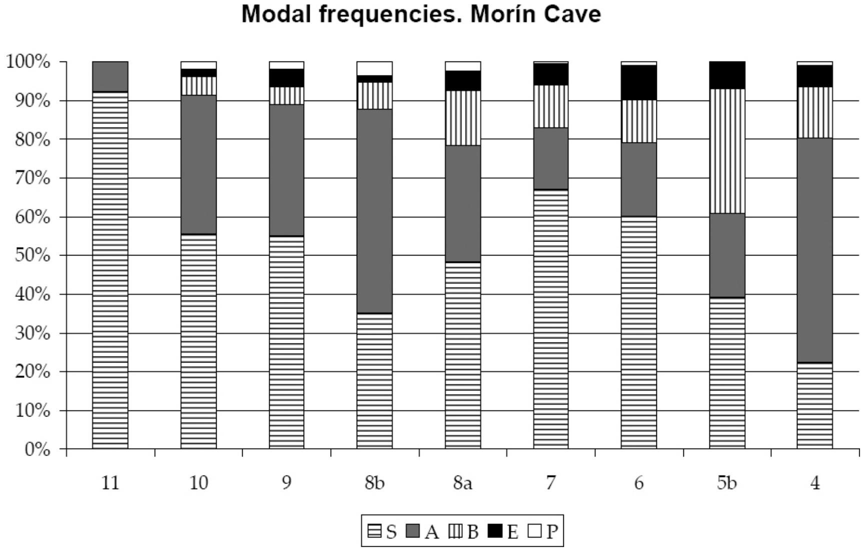


Figure 14.30: Diachronic evolution of retouching modes in some levels from Cueva Morín.

Techno-typology of the transition period

In this section we shall try to outline the main guidelines which guided the making and use of the variety of lithic and bone artefacts during this turbulent period. Let us say in advance that, if we were capable of applying the same methodological protocol to the study of the collections from the entire transition period, it would not be so easy to find criteria which clearly separate the end of the Mousterian from the beginning of the Upper Palaeolithic. At the very least, more discussion is required regarding the relevance of the currently used criteria for describing and interpreting the process which marks the passage from one period to the other.

Ample mention has already been given to the management of lithic raw materials and technology in this paper. If we compare the extremes of the chronological spectrum which starts around 42 000 and ends at 27 000, it is easy to observe sharp contrasts between the assemblages. If we try to focus instead on when and how these changes were introduced, however, it becomes quite difficult to establish fixed points in time, especially within a wide geographical range.

The bone industry of the Mousterian is characterised by minimally worked pieces, in which retouchers, a few awls and bone tools retouched in a way which is reminiscent of lithic techniques, are the principal components of the assemblages. From a quantitative point of view, it cannot be considered (with the odd notable exception) that the addition of a few *sagaies* in the Chatelperronian or the Protoaurignacian introduce a notable change into these sets, and, in fact, these almost always represent elements of little qualitative weight in the series. Indeed, the latter are still represented well into the Gravettian, maintaining common blanks in the types indicated. From the Early Aurignacian onwards (the Chatelperronian of Labeko Koba, the Protoaurignacian in the case of Isturitz), these flattened *sagaies* were introduced (some of them true split-based points), and these increased in frequency whilst their cross-section became more rounded. On the other hand, though, the introduction of *chaînes opératoires* aimed specifically at obtaining projectiles could be seen as an important qualitative difference between Aurignacian industries and Mousterian ones.

In the same way, we can establish similar considerations for the lithic industry. The increase over time of flint as the main raw material, the process of "*Leptolithisation*" (laminarisation and microlithisation in parallel), the progressive introduction of blade and bladelet debitage techniques, and the replacement of the substrate typological groups (side-scrapers and denticulates) by others which are linked to the Upper Palaeolithic (burins, end-scrapers, backed bladelets or perforating elements, etc.), are clearly visible at the end of the 15 000 year period indicated above. Such aspects must always be assessed in quantitative terms, however, given that few of them act as absolute discriminating factors allowing the attribution of a collection, without any doubt, to a specific techno-complex described above. As the typologies employed differed according to the *a priori* assumptions as to the Mousterian or Aurignacian character of the assemblage, this methodological aspect has seriously distorted the perception of the transition. The application instead of a single methodological framework to the entire series, the Analytical Typology, allows us to estimate, in quantitative terms, the diachronic evolution of these variables. To illustrate this, we have attached two figures (Figures 14.29 and 14.30) showing the change in the frequency over time of the laminarity and of the different modes of retouch of tools (Simple, Abrupt, Burin, Écaillé and Plan = invasive) at Cueva Morín. It is important to emphasize, however, that our interpretations are quite different when we adopt a technological perspective which aims to determine the technical intentions and solutions to which correspond the various industries examined.

For instance, regarding bone working, from a technological and qualitative point of view, the process of "*Leptolithisation*" could also be seen in part as the signature of the search for lithic projectiles on blades (Chatelperronian) or bladelets (Protoaurignacian and Aurignacian). This aspect introduces an important difference between both industries (Chatelperronian and Aurignacian) and the Mousterian, with clear technological signatures (Bon 2006).

Restricting ourselves to the techno-typological assessment of the series, we should point out that at this point in time it is more appropriate to refer to the end of the Mousterian as that, rather than as ‘Late’ or ‘Final’ Mousterian. No industrial characteristic has been identified in the lithic record (the most abundant) which would allow us to link the nature of the assemblage to a specific chronological period of the Mousterian: in other words we cannot distinguish, merely through the lithic industry, a Final Mousterian. Within the Mousterian in the region described, we found a very high abundance (on occasions greater than 80% of the series) of substrate elements, with side-scrapers always standing out. These assemblages also contain smaller, though variable, percentages of supposedly “leptolithic” components, such as, among others, burins, *écaillés*, end-scrapers, *becs* or backed blades and bladelets, on massive, and supposedly archaic, blanks. It is the progressive increase in the leptolithic component of an industry which will determine, in final terms, to what extent an assemblage is more Mousterian in appearance or Aurignacian. Does it mean that Aurignacian technologies evolved from the Mousterian? They could belong to the same global process, but inside different traditions: a larger geographical view is necessary to answer these questions. We must add that this issue depends, among other things, on the interpretation and place given to the ‘Transitional Aurignacian’ as it has been identified in the Castillo sequence, and that the authors of this article differ in their views regarding this. Be that as it may, there are a number of conclusions with which we collectively agree:

- In this relatively slow and continuous process in the typological record, the Chatelperronian or other forms described as transitional (like the Transitional Aurignacian) in the Cantabrian area (Conde’s Cave, El Castillo Cave, Lezetxiki) may have an appearance more or less similar to that of the Mousterian, in which are inserted additional leptolithic components such as Chatelperronian points, burins or variable percentages of laminar blanks, with simple lateral or bilateral retouching. The situation is a bit different north of the Pyrenees, where the Châtelperronian seems far more detached from its presumed Mousterian origins.
- However, one can say for the whole region considered that the indisputably both leptolithic and microlithic series begin with the Protoaurignacian / Archaic Aurignacian, a complex characterised by the very high occurrence of bladelets with semi-abrupt retouch (some of them displaying Dufour characteristics) and a consequent change in the modes of Abrupt retouching – first – and Burin – later-. This development is well-known and, as a result, when the Evolved Aurignacian comes to an end and gives way to the Gravettian, the presence of lithic substrate elements is quite marginal.

Summary and research perspectives

The change in perspective which has taken place over the last fifteen years with respect to our knowledge of the early Upper Palaeolithic has been substantial, at least in the region described here. There has been a notable increase in the amount of fieldwork, the study methodology has been standardised, its resolution has improved and there has been a re-questioning of the larger topics of this highly debated period. As is to be expected, such an accumulation of new information has resulted in a view divergent from the one we had in 1990.

Each of the themes dealt with in the second part of this paper, and some not dealt with, have given rise to discussion. Intermingled with questions such as the exact chronology of the Transition, the emergence of artistic behaviour, and the anthropological characterisation of the makers of the techno-complexes of the period there exist more complex problems such as: in the so-called Transition, is continuity or rupture predominant? Is there a single Transition model or can it be accepted that in different situations a variety of responses ocurred? What is the relevance of the phyletic characterisation of the protagonists of the assemblages (Neandertals or Cro-Magnons) in the process described? Which of the various methodological and epistemological frameworks used by different prehistorians to address these issues should be used? Finally, was there really a situation in space and time when Neandertals and Cro-Magnons lived contemporaneously or is this image simply a mirage created by the generally poor resolution of the Palaeolithic record?

We understand that these questions cannot be addressed directly without first dealing with the more immediate ones which have been outlined in this article. The principal reason for the epistemological crisis affecting the study of the early Upper Palaeolithic since 1980 is probably due to having taken as is (and as understood) too many general frameworks and universal classifications. Although it is certain that a balance needs to be found between the understanding of the processes on that of a universal scale and that of a local scale, we believe that renewed knowledge of this period still requires more work at the fundamental level (dates, analyses, fieldwork, review of previously excavated sequences and publication of all this information). We are aware that, of the seven sites presented in this text, only one has been discovered and excavated for the first time in the last two decades. The geographical diversity of the location of these places (differences in access to resources, in the ecosystem in which they are found, in the living conditions) has still not been sufficiently assessed, except, perhaps, in palaeoenvironmental studies. The information must be suitably contextualised in a flexible regional framework, without artificial borders, in which we believe it is not correct to combine the data, especially if they display (as is usually the case) some notable differences.

In this sense, the example of absolute chronology may be paradigmatic (always related to the techno-cultural label of each assemblage): on a narrow base of information, distributed (by period, by area, by sites, by the period in which the dates were carried out, by the method they were obtained, by the medium used, etc.) in a very asymmetric way, we cannot ignore the fact that the same levels at Cueva Morín, dated forty years apart, have significantly different results. If we want to advance in our knowledge of this period, we have to be capable of accepting and interpreting the differences, before proposing processes and models of universal validity. Although it is necessary to address that level of abstraction, perhaps it is still a little premature to do so (Arrizabalaga and Iriarte 2006), and, in any case, we do not see any way of presenting a “closed”, “unique” or definitive model for interpreting a very complex period like this one in which many differing scientific approaches, each one with its own epistemological traditions, are involved.

Acknowledgments

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The unfortunate death of Victoria Cabrera did not allow her to leave her full mark on this text, to which she has contributed with so much vital information.

Thank you, finally, to David F. Brandon, who has read the text and faced up to the hard task of its stylistic correction, in as much as this was possible.

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15. The Ebro Frontier Revisited

João Zilhão

ABSTRACT

It was in the 1991 Madrid conference on the Middle-to-Upper Paleolithic transition in Iberia (Cabrera 1993) that I first proposed the notion that, during late Oxygen Isotope Stage 3, a biocultural frontier broadly coincident with the biogeographical divide represented by the Ebro basin stably separated for several millennia Middle Paleolithic Neandertal populations surviving in southwestern Iberia from the earliest Upper Paleolithic modern human groups of Europe (the distribution of which extended into the Cantabrian strip and northern Catalunya). Here, I propose a list of the kinds of empirical finds that, were they to be made, would refute, or force a re-evaluation of the "Ebro frontier model". I then review new data brought to light over the last 15 years, and conclude that the new paleoenvironmental, chronometric, archeological and human paleontological evidence exhibits patterns that considerably strengthen the model. In radiocarbon years, it is now clear that the frontier existed throughout the interval c. 36.5–30 ka BP (i.e. c. 42–35 ka BP, in calendar years), a period of globally milder climate during which temperate biomes underwent a marked expansion from glacial refugia, at least in the littoral areas of western and southern Iberia.

Introduction

An extensive review of recent developments in the research of the Middle-to-Upper Paleolithic transition in Iberia is provided elsewhere (Zilhão 2006a). Here, I present a summary reappraisal of the Ebro frontier model, addressing in particular those points relating to chronology and environments that were the object of recent critiques (Jöris *et al.* 2003; Utrilla *et al.* 2004). In order to proceed with greater clarity, I propose a list of the kinds of empirical findings (and corresponding implications) that, were they to be made, would force a revision, or even abandonment, of the model (or at least of some aspects of it) (Table 15.1), and discuss the extent to which, in the different realms involved, any such findings have actually been made.

The location of the sites discussed in the text is provided in Figure 15.1, and Table 15.2 contains a list of the relevant radiometric dates. Raw radiocarbon results mentioned in the text are explicitly expressed as such, in thousands of years (ka) ^{14}C BP. Calendar ages (U-Th, TL/OSL or calibrated radiocarbon ages), in turn, are expressed in years or thousands of years (ka) cal BP. Radiocarbon calibration is effected through the CALPAL software, May 2005 version (Weninger and Jöris 2005), using the SFCP age-model (Shackleton *et al.* 2004), coupled with the U-Th data of Fairbanks *et al.* (2005). Throughout, the expression "securely dated" is used as a short hand for "dated on samples archeologically well-associated and for which complete decontamination and, hence, equivalence between the measured age and the real age of the specimen can be assumed on the basis of independent chemical criteria (such as, for bone samples in particular, C:N ratio or collagen content)".

Model

The notion that the Mousterian (and, with it, the Neandertals) survived in parts of Iberia until later than elsewhere in Europe was initially put forward by Vega (1990) and Villaverde and Fumanal (1990) on the basis of chronostratigraphic inferences derived from sedimentology and micromammal studies of the cave sites of Carihuela (Granada) and Cova Negra (Valencia). Building on these suggestions, the Ebro frontier model (Zilhão 1993, 1997, 1998, 2000; d'Errico *et al.* 1998; for a concurring view of the process, see also Arsuaga 2000, 354–355) was based on the observation that a time lag existed in the patterning of the Mousterian-to-Aurignacian succession when regions north of the Ebro basin were compared with those to the south.

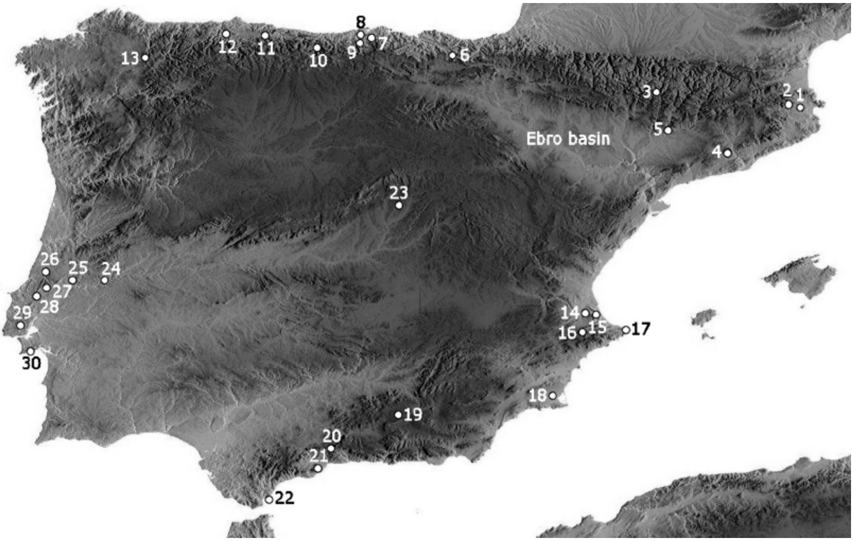

Figure 15.1. Location of Iberian sites mentioned in the text. 1. L'Arbreda and Reclau Viver; 2. Ermitons; 3. Fuentes de San Cristóbal; 4. Romaní; 5. Roca dels Bous; 6. Labeko Koba; 7. Morín; 8. Pendo; 9. El Castillo; 10. Esquilleu; 11. Sidrón; 12. La Viña; 13. A Valiña; 14. Cova Negra; 15. Mallaetes; 16. Beneito; 17; Foradada; 18. Cabezo Gordo; 19. Carigüela; 20. Zafarraya; 21. Bajondillo; 22. Gorham's; 23. Jarama VI; 24. Foz do Enxarrique; 25. Caldeirão; 26. Lagar Velho; 27. Oliveira; 28. Gato Preto; 29. Pego do Diabo; 30. Figueira Brava.

In the period between *c.* 36.5 and *c.* 30 ka ^{14}C BP (*c.* 42–35 ka cal BP), it was claimed, only those two technocomplexes are documented in the Iberian Peninsula; but, in the Cantabrian strip and along the southern flank of the Pyrenees, all archeological contexts securely dated to that period are Aurignacian; conversely, south of the Ebro basin, along the Mediterranean coast of Spain, and in

Andalucía, Portugal and the Mesetas, all such contexts are Mousterian, with dates for the Aurignacian being no earlier than *c.* 30–32 ka ^{14}C BP. It was further argued that these late dates for the Aurignacian of southern and western Iberia are consistent with the fact that, typologically, the corresponding bone and lithic assemblages contain neither split-based bone points nor lithic types characteristic of the Early Aurignacian (Aurignacian I), whereas such items are commonly found in chronometrically earlier sites situated north of the Ebro, such as La Viña, Isturitz or l'Arbreda.

The Ebro frontier model surmised that this distribution reflected a real and lasting spatial segregation between the two technocomplexes and, given their verified or assumed associations with different hominid forms, between early modern humans to the north and Neandertals to the south of the observed divide. As a possible cause for this pattern, the model suggested that, some time during Oxygen Isotope Stage 3 (OIS-3), southern and western Iberia would have differentiated into a separate biogeographical province from the Eurosiberian domains extending north of the Cantabro-Pyrenean mountain chain; at that time, peninsular environments to the south of the Ebro basin would have been predominantly temperate woodlands, contrasting with the open, steppe-like landscapes to which early modern humans dispersing across the central European plain would have become culturally adapted; Iberian Neandertals survived largely in isolation because, as the milder climatic conditions of later OIS-3 gradually set in, they developed successful adaptations to the new environments created by such conditions, which would have been unattractive to the modern human populations established to the north. In this framework, competition between the two populations for the territories of Iberia would not have developed until climatic deterioration began to favor the southward expansion of the open environments preferred by early European moderns, who expanded with them.

Table 15.1 List of potential findings that, if verified by empirical research, might possible question, in different realms, the validity of the Ebro frontier model.

Geography and paleoenvironments

- Environments south of the Ebro were no different than those to the north, or there is indeed one (or more) major intra-Iberian biogeographical division(s), but the separation between the different domains bears no relation to the Ebro basin.
- A biogeographical divide existed indeed at the Ebro during a certain interval of OIS-3, but its inception and disappearance bear no relation to processes such as the prolongation of a southern Mousterian (with the establishment of the frontier) and the spread of the Aurignacian (once it eventually vanished).

Chronometric patterns

- North of the Ebro, the earliest occurrences of the Aurignacian are as late as to the south, and the contrast is between southern France and Iberia as a whole (including the Cantabrian strip and northern Catalunya).
- North of the Ebro, the Mousterian survives alongside the Aurignacian until as late as to the south and, in fact, the Mousterian and the Aurignacian overlap significantly in every single subregion of Iberia, with no macrogeographical patterning such as that surmised by the Ebro frontier model.
- There is no moment of stasis in the westward progression of the Aurignacian, which corresponds instead to a process of gradual population spread, Aurignacian sites in geographic positions intermediate between the putative French source to the east and the Portuguese coast to the west having also intermediate chronologies.

- South of the Ebro, the Mousterian is no later than to the north
- South of the Ebro, the Aurignacian appears as early as to the north.
- South of the Ebro, there is a gap between the latest Mousterian and the earliest Aurignacian.

Relation between material culture and human biology

- There is no biunivocal association between technocomplexes and hominid forms, Neandertals and moderns being both conceivably responsible for the manufacture of either the Mousterian or the Aurignacian.
- North of the Ebro, the people making the Aurignacian are Neandertals, not moderns.
- South of the Ebro, the people making the Mousterian are moderns, not Neandertals.
- South of the Ebro, Neandertals make both the Mousterian and the Aurignacian, and the earliest moderns are Gravettian, not Aurignacian people

The model eventually provided a coherent historical background to the interpretation of the mosaic of modern and Neandertal anatomical features diagnosed in the child skeleton excavated in 1998 at the Lagar Velho rock shelter, in Portugal, interpreted as indicating extensive admixture between west Iberian Neandertals and immigrant moderns at the time of contact (Duarte *et al.* 1999; Trinkaus and Zilhão 2002). Although rejected by supporters of extreme, obsolete Out-of-Africa views of modern human emergence (*i.e.* with complete replacement of, and no biologically significant admixture with contemporary archaic populations such as the Neandertals; Tattersall and Schwartz 1999; Bräuer 2006), this interpretation was widely accepted, not only in the realm of physical anthropology but also among mainstream evolutionary geneticists and biologists (Jolly 2001; Trinkaus and Zilhão 2002; Holliday 2003, 2006; Arnold and Meyer 2006). Given the date for the skeleton (*c.* 25 ka ^{14}C BP), and the marked contrast with coeval populations in France, England, Italy, and central Europe, where no such Neandertal features were recorded, the interpretation could only stand on the basis of Iberia representing a particular situation of prolonged Neandertal survival, as indeed sustained by the Ebro frontier model. The ultimate demise of these late Iberian Neandertals would thus have resulted from the eventual operation, at a reduced geographic scale, of the same processes of cultural interaction and biological admixture that pertained in the Out-of-Africa dispersal of early modern humans into western Eurasia (Zilhão and Trinkaus 2002; Zilhão 2006b, 2006c).

Discussion

Was the Ebro basin a real biogeographical divide? Results from the pollen analysis of deep-sea OIS-3 deposits cored off the coasts of Portugal (Sánchez-Goñi *et al.* 2000, 2002; Abreu *et al.* 2003; d'Errico and Sánchez-Goñi 2003; Roucoux *et al.* 2005), representing influxes from both the Douro basin, in NW Iberia (core MD95–2039), and the Tagus basin, in SW Iberia (core MD95–2042), are fully consistent with the model. These analyses show consistently high percentages of arboreal pollen, with deciduous oaks being the most abundant termophilous tree; that this presence reflects refugial temperate forests on the adjacent mainlands is corroborated by pollen profiles from contemporary continental sites in central Portugal (Diniz 1993) and Eastern and Northeastern Spain (Carrión *et al.* 2003; González-Sampériz *et al.* 2005). Against this evidence, the ryhtmical fluctuations in the ratio between temperate/humid taxa and steppic taxa (*Artemisia*, Chenopodiaciae and *Ephedra*-type pollen), with a marked raise in the percentage of the latter during Heinrich Events (Figure 15.2), are best interpreted as reflecting the expansion and contraction of arid, steppe-like landscapes, combined with the altitudinal compression and decompression of mountain vegetation zones. During milder phases, such arid landscapes would have been largely restricted to the higher mountains but, especially in southern and eastern Spain, they would have expanded out- and downward during the coldest episodes, namely during Heinrich Event 4, originating vast expanses of temperate grasslands (d'Errico and Sánchez-Goñi 2003); even then, however, the littoral areas of these regions would have retained a significant tree cover.

Table 15.2. Relevant radiometric dates (technically reliable and/or securely associated) for late Neandertal, latest Middle and earliest Upper Paleolithic occurrences in the different regions of Iberia (after Zilhão, 2006, and sources therein; calibration after Weninger and Jöris, 2005).

Site	*Site type*	*Culture*	*Level*	*Sample type*	*Date*	*Date type*	*Lab number*	*calBP+2s*	*calBP-2s*
Catalunya									
Ermitons	Cave	Mousterian	IV	Bone fragments	36430±1800	Conv. C14	CSIC-197	44380	37860
			IV	Bone	33190±600	AMS C14	OxA-3725	40510	36470
Roca dels Bous	Cave	Mousterian	R3	Charcoal	38800±1200	AMS C14	AA-6481	44870	41750
Romaní	Rockshelter	Aurignacian	2 top	Travertine carbonates	36300±1300	Conv. C14	USGS-2839	43660	38620
			2 base	Travertine carbonates	35000±500	Conv. C14	USGS-2840	42300	38940
			2	Charcoal	37900±1000	AMS C14	AA 8037B	44180	41500
			2	Charcoal	37290±990	AMS C14	AA-7395	43610	41250
			2	Charcoal	36740±920	AMS C14	AA-6608	43140	40820
			2	Charcoal	36590±640	AMS C14	NZA-2311	42700	41300
			2	Charcoal	35400±810	AMS C14	AA-8037A	42690	38810
Aragón									
Las Fuentes de San Cristóbal	Cave	Mousterian	O	Charcoal	36050±550	AMS C14	OxA-8524	42730	40130
			P	Charcoal	36000±1900	AMS C14	OxA-8590	44170	37210
Cantabria									
Esquilleu	Cave	Mousterian	VI	Charcoal	34380±670	AMS C14	AA-37883	42050	38410
			XIf	Charcoal	36500±830	AMS C14	AA-37882	43070	40270
			XIII	Charcoal	39000±300	AMS C14	Beta-149320	44370	42330
Morín	Cave	Aurignacian	8	Charcoal	36590±770	AMS C14	GifA-96263	42850	41050
		Mousterian	11	Charcoal	39770±730	AMS C14	GifA-96264	44960	42520
Asturias									
El Sidrón	Cave	Neandertal remain	Galería del Osario	Tooth	40840±1200	AMS C14	Beta 192065	46600	42520
				Bone	37300±830	AMS C14	Beta 192066	43400	41440
				Tooth	38240±890	AMS C14	Beta 192067	44290	41730
La Viña	Rockshelter	Aurignacian	XIII lower	Charcoal	36500±750	Conv. C14	Ly-6390	42810	40930
Galicia									
A Valiña	Cave	Mousterian	III	Bone fragments	34800/+1900/-1500	Conv. C14	GrN-17729	43310	36150
			III	Bone fragments	31730/+2880/-2110	Conv. C14	GrN-20833	42750	31150
			III	Bone fragments	31600±250	AMS C14	GrA-3014	37190	35950
Valencia									
Foradada	Cave	Aurignacian	Sector I, V	Charcoal	27190±150	AMS C14	Beta-103782	31580	31180
			Sector I, V	Charcoal	29440±190	AMS C14	Beta-103781	35430	33950
			Sector I, VI	Charcoal	29950±200	AMS C14	Beta-103783	35800	34760
			Sector II, II	Charcoal	26610±460	AMS C14	Beta-132350	31620	30540
			Sector II, II	Charcoal	28300±170	AMS C14	Beta-132351	34050	31650
Mallaetes	Cave	Aurignacian	XII	Charcoal	29690±560	Conv. C14	KN-1/926	36150	33390
Murcia									
Cabezo Gordo	Cave	Mousterian	2	Burnt bone	34450±600	AMS C14	OxA-10666	42010	38610
Andalucía									
Bajondillo	Rockshelter	Aurignacian	11	Sediments and charcoal	33690±1195	AMS C14	Ua-17150	42520	35920
			11	Sediments and charcoal	32770±1065	AMS C14	Ua-18050	41180	35540
Zafarraya	Cave	Mousterian	E, EnsembleII, Unit UG42	Charcoal	30900±1300	AMS C14	OxA-7120	39470	32870
			D, Ensemble Ic, UnitUD22	M1 sup *Equus caballus*	30200±460	AMS C14	OxA-8024	36330	34570
			D, Enseble Ic, UnitUE23	M1 sup *Equus caballus*	26300±440	AMS C14	OxA-8411	31450	30330
			I8	173g of bone fragments	31800±550	Conv. C14	Gif/LSM-9140–I	39150	35350
			I3–I7	230g of bone fragments	29800±600	Conv. C14	Gif-9140–II	36330	33410
			I3–I7	Ibex tooth	26970±5160	U-Th	-	37290	16650
			I8	Ibex tooth	31700±3600	U-Th	-	38900	24500
			D	Ibex tooth	33400±2000	U-Th	-	37400	29400
Gibraltar									
Gorham's	Cave	Early Upper Paleolithic	Context 9	*Pinus* sp. charcoal	30250±700	AMS C14	OxA-7076	36820	33900
			Context 9	*Pinus* sp. charcoal	30200±700	AMS C14	OxA-7074	36800	33800
			Context 9	*Pinus* sp. charcoal	29800±700	AMS C14	OxA-7075	36500	33100
			Context 9	*Pinus* sp. charcoal	29250±650	AMS C14	OxA-7077	36020	32180
			Context 13a	*Pinus* sp. charcoal	29250±750	AMS C14	OxA-7110	36190	31830
			Context 11	Burnt bone	29100±340	AMS C14	OxA-7388	35380	33140
		Mousterian	Context 19	*Pistacea* charcoal	46700±1900	AMS C14	OxA-8526	55280	45240
			Context 19	*Juniperus/Tetraclinus* charcoal	43800±1300	AMS C14	OxA-8525	50100	44180
			Context 19	*Juniperus/Tetraclinus* charcoal	42800±2100	AMS C14	OxA-8542	50410	42730
			Context 18	Charcoal	42200±1100	AMS C14	OxA-7791	47970	43570
			Context 16 hearth (Context 24)	Charcoal	32280±420	AMS C14	OxA-7857	39480	36000
			Context 19	Shrub charcoal	31900±1400	AMS C14	OxA-8541	40600	34200
			Context 18	Charcoal	23800±600	AMS C14	OxA-7979	30110	27350
Castilla La Mancha									
Jarama VI	Cave	Mousterian	2	Charcoal	32600±1800	AMS C14	Beta-56639	42390	34030
			2	Charcoal	29500±2700	AMS C14	Beta-56638	40650	28730
Portugal									
Caldeirão	Cave	Mousterian	K top	Red deer phalanx	27600±600	AMS C14	OxA-1941	34070	30670
Figueira Brava	Cave	Mousterian	2	*Patella* shells	30930±700	Conv. C14	ICEN-387	37310	34830
Foz do Enxarrique	Open air	Mousterian	C	Horse tooth enamel	33600±500	U-Th	SMU-224/225/226	34600	32600
Oliveira	Cave	Mousterian	8	Burnt bone	31900±200	AMS C14	GrA-10200	37370	36330
			8	Burnt bone	32740±420	AMS C14	OxA-8671	39510	36550
Pego do Diabo	Cave	Aurignacian	2b	Bone fragments	28120/+860/-780	Conv. C14	ICEN-732	45900	30300

In the time period of relevance here, these landscape reconstructions carry the implication that, taken as a whole, Iberian regions located south of the Ebro basin corresponded to a subcontinent of temperate grasslands and forests that stood in marked contrast with the mammoth-steppe *cum* open boreal forest environments that continued to predominate throughout OIS-3 in the Cantabrian strip, in northern Catalunya, and in western European regions to north of the Pyrenees (van Andel and Davies 2003). This contrast must have been especially significant throughout the relatively long period of mild conditions apparent in the sequence of Greenland Interstadials (GIS) between GIS-10 and GIS-7. This period is punctuated by very short cold spells, whose effects, judging from the regionally reduced impact of the harshest of them all (Heinrich Event 4) in the pollen content of marine sediments from the Portuguese coast, must have been felt only on a short-term basis, implying perhaps, for the two to five centuries of the duration of HE4(Roche *et al.* 2004), a significant contraction and fragmentation of the littoral woodlands, soon to be reversed to the previous situation.

The interval during which a delayed Mousterian survived in southern and western Iberia broadly coincided, thus, with a period that, globally, was characterized by a milder climate and, regionally, by rather stable temperate environments. The Ebro frontier model proposed that a causal link existed between the two phenomena, and that contrasting cultural adaptations explained the stabilization throughout the interval of a Mousterian/Aurignacian (and Neandertal/modern human) divide running along the basin of that river. The recent paleoenvironmental evidence reviewed above is fully consistent with this notion, as is the well-known fact that, after 36 ka cal BP, the global climatic conditions deteriorated and mammoth-steppe environments extended west and south of the Ebro, into at least the central Mesetas, as shown by fossil finds and artistic representations of cold-adpated species, namely wolverine, reindeer and wooly rhino from a number of Upper Paleolithic sites (Garcia and Arsuaga 2003).

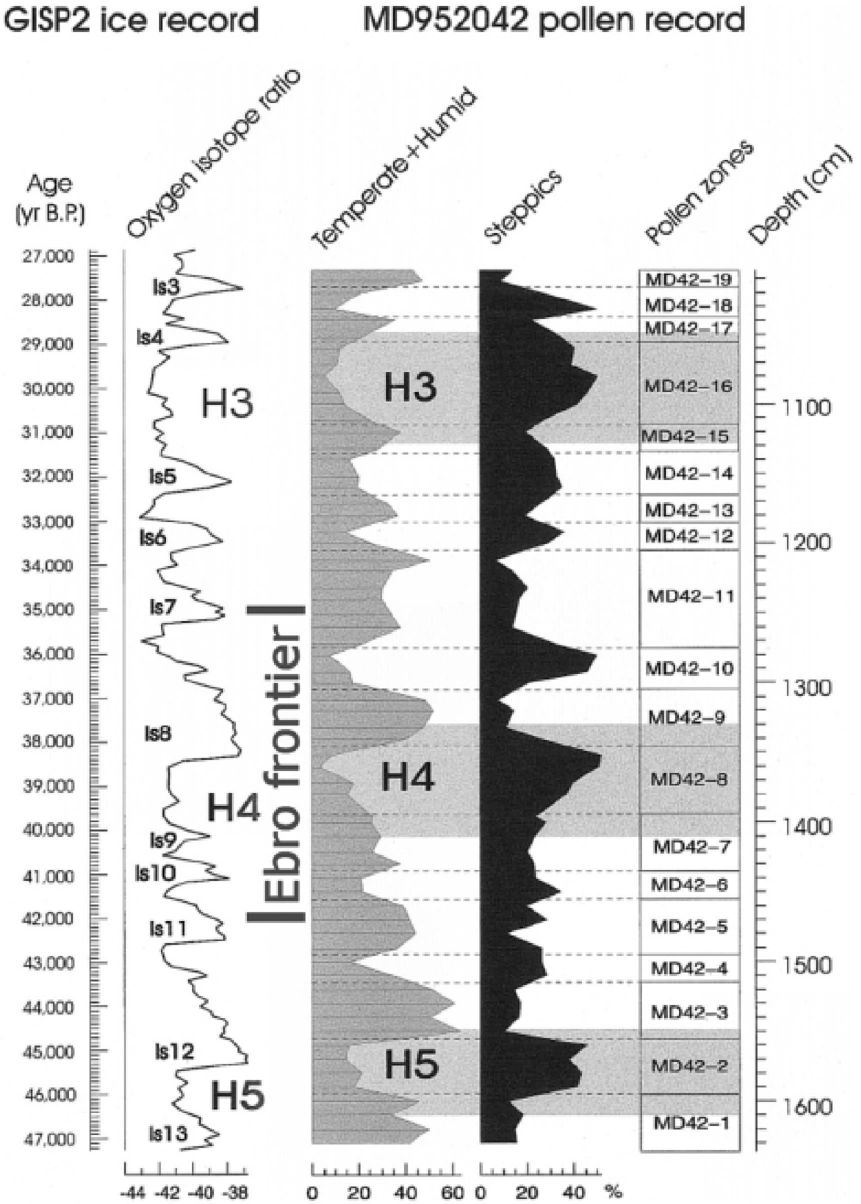

Figure 15.2. Correlation of palaeoclimatic records from the marine core MD95-2042 (SW of the mouth of the Tagus) and the GISP2 ice core, after Sánchez-Goñi et al. (2000), indicating the interval corresponding to the duration of the Ebro forntier.

Critiques of the model based on discussions of whether a frontier "line" indeed existed or whether such a "line" can actually be drawn along the course of the Ebro river proper (cf. Utrilla *et al.* 2004) are misguided by a lack of understanding of the concept of ecological frontier. Such frontiers are relatively wide and non-impermeable strips of territory where a series of clines in the distribution of an ecologically significant number of species tend to coalesce, not coincide in a linear way. Bearing in mind, where artifacts are concerned, that long-distance, down-the-line exchange can explain isolated finds in violation of the model's expectations, the following thought experiment should clarify this point. The Abric Romaní, in Capellades, at the latitude of Barcelona, north of the Ebro river, currently represents the southernmost point in the distribution of the Early Aurignacian along the Mediterranean coast of Spain; if finds of split-based bone points were to be made in areas of the provinces of Castellón, Teruel or Zaragoza adjacent to but south of the course of the Ebro, the "Ebro frontier" model would not be necessarily falsified; such would be the case only if finds of that nature were to be made well beyond the river (in terms of hunter-gatherer settlement patterns and interaction networks), in, say, Valencia, Andalucía or Portugal. Conversely, finding a late Mousterian in the Tarragona province, somewhere adjacent to but north of the river, would not falsify the model either. The same logic applies to the distribution of vegetation communities, cold-adapted mammal species, and hominid "types".

Is the Aurignacian as late in northern Spain as elsewhere in Iberia?

Claims that the Aurignacian in Cantabria and northern Catalunya began as early as *c.* 39 ka ^{14}C BP (*c.* 43.5 ka cal BP), based on dates for El Castillo, L'Arbreda and Reclau Viver (Bischoff *et al.* 1989; Cabrera and Bischoff 1989; Maroto 1994), have been extensively discussed and rejected elsewhere (Zilhão and d'Errico 1999, 2003b; Zilhão 2006a). In any case, such a very early Aurignacian would in fact contribute to a stronger "Ebro frontier" pattern; where the age of the earliest Aurignacian is concerned, the pattern would be weakened only if that age were shown to be, not older than suggested by Zilhão and d'Errico, but significantly younger, as indeed one might postulate on the basis of the dates obtained for the Basque site of Labeko Koba. Here, the Protoaurignacian in level VII is dated to *c.* 27 and to *c.* 31.5 ka ^{14}C BP, whereas the overlying Early Aurignacian in level V is dated to *c.* 23.3 and to *c.* 30.6 ka ^{14}C BP (Arrizabalaga and Altuna 2000). Even if the two most recent clearly must be rejected, the other results, coming from samples collected in a modern excavation, with well-controlled proveniences, and obtained by the AMS method, might thus be construed as indicating that the earliest Aurignacian is in fact as late in northern Spain as it is in Valencia, Andalucía or Portugal.

In all likelihood, however, the Labeko Koba results simply represent a good Iberian example of the phenomenon of marked rejuvenation of dates from bone samples collected in porch areas of cave sites submitted to chemical leaching for many millennia; this phenomenon is well documented elsewhere in Europe, at the Grotte du Renne (Arcy-sur-Cure), in France, and at Sesselfelsgrotte, in Germany (Zilhão and d'Errico 2003a). Such a conclusion is consistent with the fact that the available three results for the Châtelperronian level IX of Labeko Koba – between *c.* 26.6 and 34.2 ka ^{14}C BP – are equally rejuvenated. Occurrences of the Protoaurignacian in adjacent regions to the east, at Isturitz (French Basque Country), and to the west, at Cueva Morín (Cantabria), are well dated to *c.* 36.5 ka ^{14}C BP (Zilhão and d'Errico 1999; Maíllo *et al.* 2001). Given the similar age obtained for the basal Aurignacian at La Viña (Fortea 1995, 1999), the time of arrival of the earliest Aurignacian in Asturias, Cantabria and the Basque country can be set beyond reasonable doubt somewhere during the 37th millennium ^{14}C BP (late 43rd/ early 42nd millennium cal BP).

Bischoff *et al.* (1994) reported AMS dates in the 35–38 ka ^{14}C BP range on charcoal and on carbonates from the tufa enclosing an Aurignacian level at Abric Romaní. The samples were collected in remnant deposits adhering to the back wall of the shelter, correlated with layer 2 of the old excavations and assigned to the "Archaic Aurignacian". The level in fact seems to be a multicomponent unit that originally also contained remains from a Gravettian occupation (Canal and Carbonell 1989, 367), in agreement with the fact that Bischoff *et al.* also obtained results of *c.* 23 and *c.* 29 ka ^{14}C BP for two other samples from the same remnant. Bearing in mind that some of the charcoal may have been non-anthropic, and also that some of it may as well pre-date, or post-date, the documented occupations, matching any given date to any one of the technocomplexes represented in the artifact assemblage entails a certain amount of circularity. However, the presence of the Dufour subtype of Dufour bladelets gives some credence to the notion that the earlier cluster of results (or at least some of them) indeed dates a Protoaurignacian occupation of the site, coeval with that of the Cantabrian strip (Figure 15.3).

Is there a long-term overlap between the Mousterian and the Aurignacian in northern Spain?

Following-up on previous reservations (Hoyos and Laville 1982; Laville and Hoyos 1994), the recent work of Montes and Sanguino (2001) made it clear that earlier claims (González Echegaray 1980; Bernaldo de Quirós 1982) for an interstratification of the Aurignacian and the Châtelperronian at El Pendo are no longer tenable. On the basis of the radiocarbon dating patterns, however, the notion of a long-term overlap between the Aurignacian and a delayed Mousterian has again been explicitly proposed for northern Catalunya and Aragón (Maroto *et al.* 1996, 2001–2002; García *et al.* 2001), and is conceivable in Cantabria, given the results reported for the Esquilleu sequence (Baena *et al.* 2001).

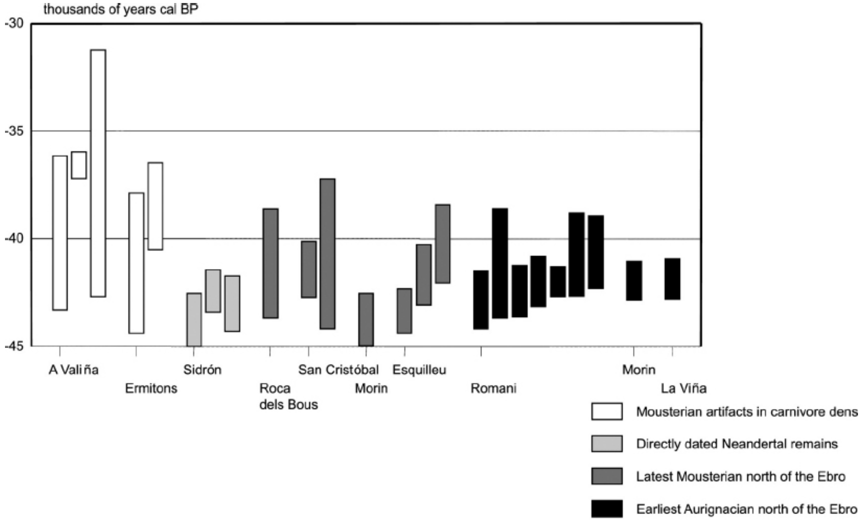

Figure 15.3. Calibrated radiocarbon dates for the Middle-to-Upper Paleolithic transition in Iberia north of the Ebro.

In Aragón and Catalunya, the argument of long-term overlap is based on chronometric results obtained at two sites, Fuentes San Cristóbal (Huesca) and Ermitons (Girona). In the first site, a Mousterian point is the only artifact recovered in level O, associated with a date of *c.* 36 ka ^{14}C BP (Bronk Ramsey *et al.* 2002, 25); especially when the corresponding standard deviation is considered, this date is in no way inconsistent with the hypothesis that there is no Mousterian in the region after the arrival of the Aurignacian; underlying level P yielded a statistically identical result as well as a third one of *c.* 27.2 ka ^{14}C BP, which the excavators reject as clearly intrusive (*ibidem*). At Ermitons, level IV yielded two dates, of *c.* 36.4 and *c.* 33.2 ka ^{14}C BP. Maroto *et al.* (1996) argue that the second date, from an unidentified bone sample collected in the stratigraphic profile and obtained through AMS, is more reliable than the first, conventional result, and would prove a survival of the Mousterian in the region until well after the arrival of the Aurignacian. Level IV of Ermitons, however, is a cave bear den, and, assuming that the AMS result does not simply reflect undetected sample contamination, the parsimonious interpretation of the evidence is that cave bears lived at the site *c.* 33 ka ^{14}C BP, long after it was abandoned by the human group who discarded the few Mousterian lithics recovered in that level. The most recent reliable date for the Mousterian in Catalunya is therefore that of *c.* 38.8 ka ^{14}C BP (*c.* 43.2 ka cal BP) for level R3 of Roca dels Bous (Terradas *et al.* 1993).

In Cantabria, uppermost level VIF of the Mousterian sequence of Esquilleu yielded an AMS result on charcoal of *c.* 34.3 ka ^{14}C BP, consistent with dates on similar samples of *c.* 36.5 and *c.* 39 ka ^{14}C BP for underlying levels XIF and XIII. When calibrated with CALPAL (Weninger and Jöris 2004), these results do indeed overlap those for the earliest Aurignacian of Isturitz, Morín and La Viña. The apparent long-term contemporaneity with the latter, however, is more likely to result from the limited resolution of available dating methods than from the actual late survival of the Mousterian in some parts of the region (for a detailed discussion, cf. Zilhão 2006a). Châtelperronian status has been claimed for material excavated at the cave site of A Valiña, in Galicia (Llana and Soto 1991; Fernández *et al.* 1995), but the artifactual evidence (a broken curved backed quartz piece in an otherwise clearly Middle Paleolithic assemblage) is too thin to warrant the diagnosis. Three conventional and AMS bone dates between *c.* 31.6 and *c.* 34.8 ^{14}C BP exist for this context; if not related to issues of undetected contamination, this spread is likely related to the fact that the level is a hyena den and, thus, as at Ermitons, the dated bones are unlikely to be associated with the human use of the site.

Therefore, unless one were to accept that the Aurignacian is as early as initially claimed for El Castillo or L'Arbreda, neither in the Cantabrian strip nor in Catalunya, does the evidence support the notion of a long-term, mosaic coexistence, at a micro-regional level, of Aurignacian moderns and Mousterian Neandertals, beyond what is to be expected in the first place as a simple result of the limited resolution of stratigraphies and chronometric techniques and of the experimental nature of available calibration procedures. In this context, the simple fact that a given region is not totally devoid of human occupation for any significant period of time inevitably generates patterns of overlap such as those apparent when plotting available dates for the Middle-to-Upper Paleolithic transition in Iberian regions north of the Ebro (Figure 15.3); south of it (cf. Figure 15.6 below), the overlap is less significant because the transition is later (and, therefore, not so close to the practical limits of radiocarbon dating and inherent higher probability of error or uncertainty in the measurements).

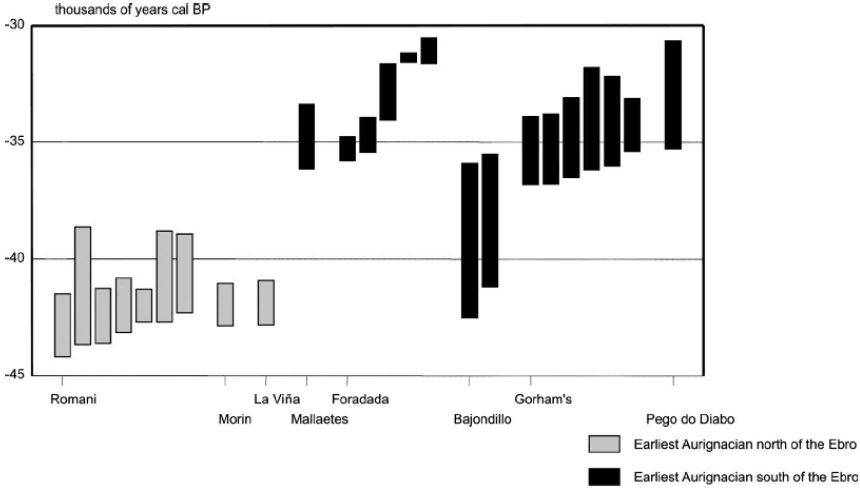

Figure 15.4. Calibrated radiocarbon dates for the earliest occurrences of the Aurignacian in different regions of Iberia. Under the Ebro frontier model, only the Bajondillo results are anomalous (see text).

Is the earliest Aurignacian in Valencia and Andalucía of intermediate age between that of Portugal and that of northern Spain?

Two concordant dates of *c.* 33–34 ka ^{14}C BP obtained for Aurignacian level 11 of Bajondillo cave (Málaga) (Baldomero *et al.* 2001; Cortés 2003) might be taken to indicate that no moment of stasis in fact exists in the westward progression of the Aurignacian across Iberia (Figure 15.4). The earliest ages for the technocomplex would instead pattern as a gradual N-S and E-W increase with distance from the nearest continental European source in France. The artifact assemblage from Bajondillo level 11 is diagnostic, and the samples come from what seem to be real combustion areas (blackened cuvettes over whitish deposits laying on reddened cobbles).

However, the composition of the dated material is not clear, and the samples are described as being of "sediments and charcoal". It is thus possible that the results reflect important contamination from bedrock, leading to results older than the real age of the human activity they are supposed to date. This kind of contamination tends to be a problem only in the direct dating of rock art pigments, because of the often very small amounts of sampled material, and of the general lack of appropriate taphonomic analyses of the provenience of the carbon contained therein (Fortea 2000–2001). At Bajondillo, however, the cave/shelter is excavated into late Middle or early Upper Pleistocene travertines, which means that, with the sediment fill coming to a large extent from the degradation of the walls, the "sediment" in the hearth samples must have incorporated marginally radioactive carbon material much older than the wood burned there, and in an unknown proportion. Such a contamination would explain well the contradiction between radiocarbon and TL; in fact, the latter method, applied to samples of burnt flint, yielded significantly younger results – 26,013 ± 2777 cal BP (MAD-2482) for the upper part of level 11 and 28,019 ± 2334 cal BP (MAD-2559) for its middle part, whereas the two statistically identical radiocarbon results available for the level average *c.* 38.8 ka cal BP (Table 15.2).

The typological and technological features of the Bajondillo assemblage – dominated by carinated and thick-nosed scrapers, and with some Dufour bladelets of Roc-de-Combe subtype, whose characteristic small, twisted blanks are well represented in the debitage (Cortés and Simón 1998, 2001; Cortés 2003) – are also more consistent with an Evolved Aurignacian (Aurignacian II) than with an Early Aurignacian. Given the typological data, the parsimonious interpretation of the Bajondillo evidence is that it is coeval with similar occurrences of the technocomplex in Alicante and Valencia, dated on charcoal to *c.* 29.7 ka ^{14}C BP at Mallaetes (Valencia) (Fortea and Jordá 1976), and to *c.* 27–30 ka ^{14}C BP at Foradada (Alicante) (Casabó 2001).

An intermediate age for the Aurignacian of Valencia has also been claimed on the basis of a *c.* 34 ka ^{14}C BP charcoal date for level C of Beneito (Iturbe *et al.* 1993). Following up on the reservations of Villaverde *et al.* (1998), Domenech (2004), however, has shown that the assemblage contained therein is very poor and undiagnostic, and that the charcoal relates to natural fires, not human activity. Moreover, that level is situated in intermediate position between a clear non-laminar Middle Paleolithic in level D and overlying Gravettian deposits whence actually came the only two artifacts upon which an Aurignacian diagnosis had been proposed for level C, a pierced animal tooth and a fragment of worked bone; according to Domenech, both items, originally reported as having been found in C, in fact fell from extant profiles at the time of excavation.

Is the very late Mousterian of southern Spain and Portugal an artifact of dating error?

Jöris *et al.* (2003) reject the reality of a late Mousterian survival south of the Ebro on the basis of several problems with the associated samples. Where Portugal is concerned, their position is based on statements which, in two important cases, are innacurate:

- At Foz do Enxarrique (Ródão), an open air site on the Tagus, across the border with Spain, an abundant and characteristic late Mousterian assemblage is associated with a faunal assemblage U-Th dated to 33,600 ± 500 cal BP (average of three samples of horse tooth enamel) (Raposo *et al.* 1985; Brugal and Raposo 1999). In the radiocarbon time scale, this result is equivalent to *c.* 28.5 ka ^{14}C BP, and Jöris *et al.* do not question its technical accuracy; instead, they quote Zilhão (1997) to suggest that the "relation between the (…) artifacts and the faunal material dated at this site remains unclear". In fact, that source is adamant in stating that, although the anthropic nature of the fauna is conceivably questionable, the context of the finds indicates a short-term accumulation and, hence, even if the archeological level were a palimpsest of two functionally unrelated assemblages (anthropically accumulated artifacts and naturally accumulated bones), there could be no doubt that they are geologically associated and contemporary.
- At the cave of Figueira Brava (Sesimbra), a sample of *Patella* shells has been conventionally dated to 30,930 ± 700 ^{14}C BP (Antunes, 1990–1991, 2000), and the associated artifacts are Middle Paleolithic (Cardoso and Raposo 1995; Raposo and Cardoso 2000). Jöris *et al.* reject the radiocarbon date because "two U-series measurements of the same sample gave strongly divergent results with extremely high standard deviations [30.6 ± 11.8 and 44.8 ± 15.9 ka cal BP]". This is incorrect. Those U-series measurements were made on separate samples of red deer molars, not on the same sample of *Patella* shells. Independent corroboration of a geologically recent age for the Figueira Brava deposits is provided by dating of nearby sand beach deposits in the Forte da Baralha platform, located at the same elevation as the entrance to the cave (Pereira and Angelucci 2004); a sample of rolled shell fragments was dated to 31,540/ +1540/-1290 ^{14}C BP (ICEN-1128), and a sample of well preserved, complete *Mytilus* shells was dated to 33,730/ +3990/-2660 ^{14}C BP (ICEN-1131).

Jöris *et al.* (2003) a priori reject the validity of all dates on bone samples, on the basis of the argument that comparison with dates on charcoal suggests that bone dates tend to be rejuvenated. As also pointed out by Zilhão and d'Errico (1999), this is indeed some times, but not always the case; and, at Gruta da Oliveira, in the Almonda karstic system (Torres Novas), available but as yet unpublished charcoal dates for levels 13–15 are consistent with the results of *c.* 31.9 and *c.* 32.7 ka ^{14}C BP obtained on burnt bone samples from uppermost level 8 (Zilhão 2000, 2004), the artifact component of which has been fully described and is unmistakeably Middle Paleolithic in nature (Marks *et al.* 2001). Likewise, at Gruta do Caldeirão (Tomar), a result of *c.* 27.6 ka ^{14}C BP for the upper part of level K is fully consistent with both the stratigraphically coherent series of results for the immediately overlying Upper Paleolithic sequence (Zilhão 1997) and with the climatic and relative chronological inferences derived from magnetic susceptibility analyses of the deposits (Ellwood *et al*. 1998, 2001).

The results from these two sites are in turn fully consistent with the two AMS charcoal dates of *c*. 32.6 and *c*. 29.5 ka ^{14}C BP for the Mousterian in upper level 2 of the Jarama VI cave, Guadalajara (Jordá 2001), not mentioned by Jöris *et al.* These authors also deem as "transitional", and possibly corresponding to a palimpsest, the Gorham's cave (Gibraltar) deposits whence charcoal results in the *c*. 32 ka ^{14}C BP range were obtained: contexts 19, 18, and 16 (Barton *et al*. 1999; Pettitt and Bailey 2000). The excavators, however, describe these contexts as Mousterian. They do acknowledge that problems of integrity may well apply to contexts 19 and 18, in both cases dated by pairs of very different dates (*c*. 42.8 and *c*. 31.9 ka ^{14}C BP for context 19, *c*. 42.2 and 23.8 ka ^{14}C BP for context 18), but as the excavators explicitly point out (comment in Bronk Ramsey *et al.* 2002, 26), there is no reason to question the result of *c*. 32.3 ka ^{14}C BP obtained for an in situ feature in context 16 (a hearth also individually designated as context 24). Thus, when all the evidence is duly considered, "the latest Middle Paleolithic at Gorham's dates to between 33,000 and 29,000 BP", and "a pasimonious reading of the age ranges (…) would suggest that this is most likely to be around 31,000 BP, which agrees well with estimates for the latest Middle Paleolithic elsewhere in southern Iberia" (*ibidem*). This conclusion is all the more reasonable if we bear in mind that Gorham's earliest Upper Paleolithic levels, possibly Aurignacian but unfortunately lacking in diagnostic material, are those in Contexts 9, 11 and 13a, AMS dated to *c*. 30 ka ^{14}C BP on the basis of six statistically identical results, five on samples of *Pinus* sp. charcoal and one on burnt bone.

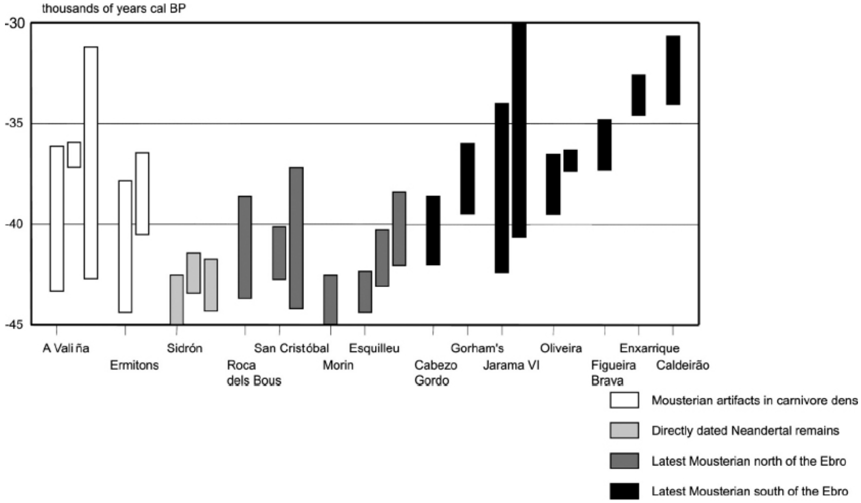

Figure 15.5. Calibrated radiocarbon dates for the latest occurrences of the Mousterian in different regions of Iberia.

As Figure 15.5 makes it clear, the Mousterian continues until much later in regions south of the Ebro than in regions to the north. The real point of contention is whether such a prolongation extends beyond *c*. 30 ka ^{14}C BP (*c*. 35 ka cal BP), as suggested by the results for Caldeirão and Enxarrique and as claimed by Finlayson *et al.* (2006) for Gorham's. Where the Portuguese sites are concerned, it remains possible that this pattern is an artifact of problems relating to dating technique and stratigraphical uncertainty (Zilhão 2006a): the uranium uptake assumptions used at Enxarrique may have been in error, and, since all other samples from the uppermost Middle Paleolithic level of Caldeirão (level K) failed due to lack of collagen, it cannot be excluded that the sample successfully dated to *c.* 27.6 ka ^{14}C BP was downward displaced from immediately overlying early Upper Paleolithic level Jb.

Where the Gibraltar site is concerned, the notion that Middle Paleolithic Neandertals survived in the region until 28 or even 24 ka ^{14}C BP is based on the spread (between *c.* 32.6 and *c.* 23.4 ka ^{14}C BP) of a series of 22 dates for a combustion area in level IV of the back part of the cave. However, given the microscopic size of the dated charcoal particles, it cannot be excluded that the results younger than *c.* 30 ka ^{14}C BP simply represent incomplete decontamination; and, given that early Upper Paleolithic people used the cave entrance, it is also conceivable that the $\leq$30 ka ^{14}C BP results relate to charcoal abandoned by those people in the framework of activities carried out further inside (such as art, represented by both paintings and engravings in the walls of this back part of the cave; Balbín *et al.* 2001). Whichever explanation eventually proves to be the correct one, the fact that Gorham's entrance was occupied since *c.* 30 ka ^{14}C BP by early Upper Paleolithic people suffices to reject the proposition that its back part continued to be inhabited by Middle Paleolithic people for another two to six millennia (Zilhão and Pettitt 2006).

Is the Aurignacian as early in southern Spain and Portugal as in northern Spain?

The open air site of Gato Preto, in Portugal, contained a small, spatially restricted lithic assemblage in a single archeological level, whose integrity is attested by significant levels of refitting and core reconstruction (Almeida 2000). The specialized nature of the occupation, heavily related to the debitage of thick-nosed "scrapers", precludes absolute certainty as to its taxonomic affinities, the observed technology being consistent with both an Evolved Aurignacian and a Terminal Gravettian or Protosolutrean. Initially (Marks *et al.* 1991; Zilhão 1993), the first alternative was favored; subsequently, the second was retained, despite a TL date of 38,100 ± 3900 cal BP, which was thought to be too old and probably related to undetected technical problems (Zilhão 1997; Almeida 2000). Subsequent developments in the calibration of radiocarbon dating (Weninger and Jöris 2005), however, now make it clear that the TL date for Gato Preto is in fact equivalent to a radiocarbon age of *c.* 32.5 ka ^{14}C BP, and, thus, is fully consistent with an Evolved Aurignacian chronology, as originally hypothesized. Moreover, a recent revision of the main technological and typological features of the assemblage shows that it is much closer to the Evolved Auirgnacian levels of, for instance, the Abri Pataud, in France, than with the Terminal Gravettian or Protosolutrean of Portugal (Zilhão 2006d).

Given its large standard deviation, the age obtained for Gato Preto is fully consistent with the conventional bone date of *c.* 28.1 ka ^{14}C BP obtained for the small assemblage with Dufour bladelets of the Dufour subtype recovered in level 2 of the cave site of Pego do Diabo (Zilhão 1997), and, thus, with a prolongation of the Mousterian in these regions until *c.* 32–30 ka ^{14}C BP (*c.* 37–35 ka cal BP). That this bladelet tool type, characteristic of the Protoaurignacian, reappears in the later Aurignacian is independently documented in France by level 6 of Abri Pataud (Chiotti 1999). Therefore, the presence of the type in an ensemble of intrusive material recovered in the uppermost deposits of the Zafarraya cave sequence does not necessarily imply, contrary to suggestions by Barroso *et al.* (2003), that the Protoaurignacian *sensu strictu* (*i.e.* such as documented at l'Arbreda, Labeko Koba and Morín) also exists in regions to the south of the Ebro divide.

Is there a gap between the Mousterian and the Aurignacian in southern Spain and Portugal?

The chronometric data for the Aurignacian south of the Ebro are not only fully consistent with the characteristics of the artifact assemblages (in their presence of types and traits, as well as in their absence of such diagnostic items as split-based bone points), they are also fully consistent with the finding that these regions of Iberia also feature a prolongation of the Mousterian. Put another way, the fact that the appearance of the Aurignacian is in these regions so late does not mean that there is a gap with the preceding Mousterian, as would have to be the case if, as hypothesized by Finlayson *et al.* (2000), Neandertals had gone extinct on their own well before the immigration of modern humans. There is no gap (Figure 15.6) and, in the intervening time period, southern and western Iberia were indeed occupied by Neandertal people forming the indigenous populations with which modern humans had to deal once they started to disperse into these regions.

Is there a clear association between technocomplexes and human "types"?

The point above assumes that the Mousterian was manufactured solely by Neandertals and that the Aurignacian, in turn, is solely associated with modern humans. The first term of this proposition is difficult to question, since abundant Mousterian-associated Neandertal remains exist in Iberia, for instance at Sidrón (Asturias), where three samples of Neandertal bone and teeth have been directly dated to *c.* 37.3–40.8 ka ^{14}C BP (*c.* 42.4–44.6 ka cal BP), their paleontological classification having been independently confirmed by aDNA analysis (Lalueza *et al.* 2005). In contrast, no remains of modern humans have ever been recovered in the hundreds of Iberian Mousterian contexts found, tested or excavated since the mid-nineteenth century.

Where the second term of that proposition is concerned, Garralda and Vandermeersch (2002) and Garralda (2005–2006) pointed out the non-diagnostic nature of the fragmentary human remains associated with the earliest Aurignacian of southwestern Europe, including northern Spain. In Eastern Europe, however, diagnostic modern human remains are directly dated to *c.* 35 ka ^{14}C BP at the site of Oase, in Romania (Trinkaus *et al.* 2003a, b, 2006). These remains thus date to the time range of the Protoaurignacian even if, unfortunately, they lack an immediate archeological context. Elsewhere in Europe, no diagnostic human remains are currently known from Protoaurignacian and Early Aurignacian contexts. At present, therefore, it cannot be excluded that, in northern Spain, the Protoaurignacian and the Early Aurignacian were in fact manufactured by Neandertals, although no clues that such might have been the case exist either. Were things to have been so, the biological and cultural aspects of the "Ebro frontier" as initially formulated would have to be decoupled. Yet, reformulated as a cultural/technological/environmental/adaptive frontier between Middle Paleolithic (Mousterian) Neandertals to the south, and Upper Paleolithic (Châtelperronian, Protoaurignacian and Early Aurignacian) Neandertals to the north, the model would still stand.

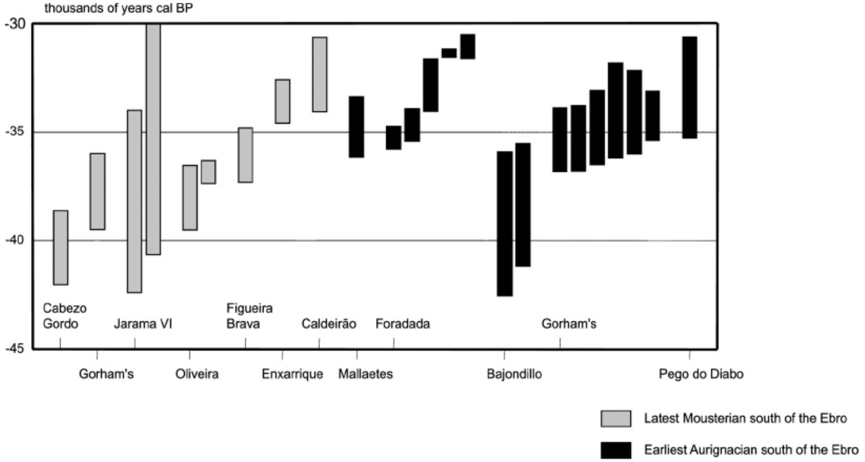

Figure 15.6. Calibrated radiocarbon dates for the Middle-to-Upper Paleolithic transition in Iberia south of the Ebro. Under the Ebo frontier model, only the Bajondillo results are anomalous (see text)

Who made the Evolved Aurignacian of northern Iberia?

In the French region of Aquitaine, two juvenile mandibles from the sites of Les Rois and La Quina Aval, both of early modern human affinities (Trinkaus 2005), are almost certainly of Evolved Aurignacian age, even if not yet directly dated; the Les Rois sequence is entirely homogeneous (Mouton and Joffroy 1958), whereas the La Quina material comes from level 3 of the old excavations, AMS dated on a bone sample from a recent sounding to *c.* 32.6 ^{14}C BP (*c.* 38 ka cal BP) (Dujardin 2001). These associations indicate that the Evolved Aurignacian of the geographically and environmentally contiguous regions of northern Spain is also the work of modern humans. The implication is that, south of the Ebro, the replacement of the late Mousterian by the Evolved Aurignacian can be legitimately modeled as a process of change in both the biological and cultural realms even in the unlikely scenario that Neandertals were involved in the manufacture of the Protoaurignacian and the Early Aurignacian of the Cantabrian strip and northern Catalunya.

Who made the late Mousterian of southern and western Iberia?

The last statement assumes that, south of the Ebro, the latest Mousterian is still the work of Neandertals. In theory, other possibilities exist as well, for instance that the region was at this time occupied by Middle Paleolithic moderns that had immigrated from north Africa. One could even speculate, in such a scenario, that other alternative formulations of the "Ebro frontier" are possible; for instance, to the exact opposite of what the model originally proposed, that the frontier actually separated Upper Paleolithic (Châtelperronian, Protoaurignacian and Early Aurignacian) Neandertals to the north from Middle Paleolithic moderns to the south, where Neandertals would have disappeared much earlier, not much later! Yet another possibility would be that Neandertals disappeared at broadly the same time everywhere in Iberia but, to the north, were replaced by Upper Paleolithic moderns immigrating from continental Europe and, to the south, by Middle Paleolithic moderns immigrating from north Africa. As in one of the scenarios, the frontier would still be a useful concept in the realm of culture, but in this case it would have separated adaptively different groups of moderns instead of adaptively different groups of Neandertals.

Until diagnostic and securely dated human remains are found in the later Mousterian of southern Iberia and Portugal, no certainty over any of this is of course possible. It must be noted, however, that Neandertal remains have been recovered in the uppermost fill of the long stratigraphic sequence from Cabezo Gordo (Murcia), in association with an AMS date on burnt bone of *c*. 34.4 ka ^{14}C BP (*c*. 40.3 ka cal BP) and in levels that are still overlain by >1 m of deposits containing the same kinds of Mousterian lithics (Walker *et al.* 2004). In the absence of any evidence to the contrary, the parsimonious way of interpreting this pattern is to take the stratigraphic and cultural continuity as an indicator of continuity in population as well.

This is all the more so since, in spite of its problems, the evidence from the cave site of Zafarraya (Málaga) suggests that the deposits containing the site's well-known diagnostic Neandertal mandible are indeed of very late Mousterian age, as proposed by Hublin *et al.* (1995). These authors, in fact, reported conventional bone dates for Mousterian levels I3–I7 and I8 of Zafarraya, supported by U-Th dating of ibex teeth, which place the deposition between *c*. 30 and *c*. 32 ka ^{14}C BP; underlying level D, which yielded that complete Neandertal mandible, was in turn U-Th dated to *c*. 33.4 ka cal BP. Recently, however, Michel *et al.* (2003) raised doubts as to the reliability of U-Th at the site because of the low uranium content of the samples, which led to many instances of lack of correlation between calculated age and stratigraphic depth. The significance of a battery of new AMS dates on charcoal samples is in turn impaired by the fact that most were collected in a disturbed section of the profile. Of the two collected in the area and level where the mandible was found, one yielded a result of *c*. 30.9 ka ^{14}C BP, but the other, at *c*. 15 ka ^{14}C BP, was also clearly intrusive; two horse tooth samples collected some 20cm above the human mandible, however, yielded ages of *c*. 30.2 ^{14}C BP and *c*. 26.3 ^{14}C BP.

Given the stratigraphic problems, all that can be said about Zafarraya is that the probability is high that the site featured a chronologically late Mousterian occupation, and that the Neandertal mandible recovered has an age >30 ka ^{14}C BP. The notion that this mandible and the other human remains associated with it date to the *c*. 30–35 ka ^{14}C BP interval, recently reasserted by Hublin and Bailey (2006), remains a reasonable reading of the evidence, but must await confirmation from direct dating of the fossils themselves. In any case, given the evidence from Cabezo Gordo, there can be little doubt that the late Mousterian of southern (and, by implication, western) Iberia is indeed the work of refugial Neandertal populations.

Who made the earliest Upper Paleolithic of southern and western Iberia?

The only human remains associated with the Aurignacian south of the Ebro are those from the cave site of Foradada (Alicante) listed by Arsuaga *et al.* (2001). However, all come from Sector II of the site, where later prehistoric levels overlie the sequence. Given the fragmentary nature of the skeletal elements in question (four in total), the possibility that this human material is intrusive cannot be excluded at present. In any case, they remain undescribed, precluding further speculation as to their significance.

Under the assumption that there is no necessary link between categorical entities of material culture and the biological affinities of the human groups that make them, which may be of diverse nature, the fact that the Evolved Aurignacian of France and, hence, probably of northern Spain as well, was made by modern humans does not mean that such is also the case in southern Spain and Portugal. In fact, one could argue that the marked presence of clear Neandertal traits in the Lagar Velho child indicates that Neandertals were still around during the first stages (Evolved Aurignacian, and perhaps even early Gravettian) of the Upper Paleolithic of at least Portugal, if not southern Spain as well. Were this to be eventually verified in the future, some of the "Ebro frontier" parameters would have to be accordingly modified, or adjusted, but the core aspects of the model would still remain fully valid.

Conclusion

This review of the evidence leads me to conclude that two central features of the "Ebro frontier" model as originally formulated not only have not been falsified but, in fact, have been considerably strengthened by the new evidence accumulated over the last 15 years: 1) that, for a significant stretch of OIS-3, roughly between *c.* 39 and *c.* 32–30 ka ^{14}C BP (*i.e.* between *c.* 43.5 and *c.* 37–35 ka cal BP), the Cantabro-Pyrenean mountains and the adjacent basin of the Ebro river represented a major biogeographical divide, separating the continental Eurosiberian steppe-tundra from an Iberian core featuring a mosaic of temperate grasslands and woodlands, with forest development being especially important in the littoral areas along the southern Mediterranean and the western Atlantic façades of the Peninsula; 2) that, between *c.* 36.5 and *c.* 30 ka ^{14}C BP (*i.e.* between *c.* 42 and *c.* 35 ka cal BP), this divide stably separated populations of Middle Paleolithic technology, to the south, from populations of Upper Paleolithic technology, to the north. The amount of empirical data already available suffices to surmise that these patterns are unlikely to change in the future (although the upper limit of the interval – *c.* 32 or *c.* 30 ka ^{14}C BP – remains to be established with greater precision).

The few physical anthropological data available are also consistent with the notion that the cultural frontier represents a proxy for a biological frontier. This evidence does not exclude other possibilities, though, and only a wealth of diagnostic fossil finds from very precise cultural contexts and diverse regional proveniences would be able to produce a definitive clarification of the issue; given how rare such finds tend to be, an important level of ambiguity will most certainly remain for quite some time. This ambiguity, however, can be circumscribed to two points in particular: the authorship of the Protoaurignacian and the Early Aurignacian in northern Spain; and the authorship of the Evolved Aurignacian and the early Gravettian in southern Spain and Portugal. Where the issue of who were the protagonists of the prolonged Mousterian occupation of Iberian regions south of the Ebro is concerned, there seems to be little reason to doubt that they were indeed Neandertal peoples.

The existence of a link between this archeological pattern and the environmental history of Iberia at this particular time is hard to deny. In all likelihood, however, the "Ebro frontier" is also related to broader demographic patterns (Zilhão 2006b, c). Soon after the first penetration of the continent by modern human groups, the impact of Heinrich Event 4 in regions to the north of the Pyrenees, aggravated by the effects of the Phlegraean Fields caldera explosion in central and eastern Europe, caused a demographic crash that must also go a long way into explaining why Iberian Neandertals were "left alone". Significantly, the disappearance of the "Ebro frontier" takes place in Evolved Aurignacian times, which, in those parts of Europe, are characterized by a marked increase in population numbers (signaled by a significant northward expansion of the human range and by the appearance of archeological indicators – namely the emergence of figurative art – of intensified levels of social interaction). Thus, demography may go a long way into explaining why moderns did not disperse into the Neandertal territories of southern and western Iberia until after GIS-8 (*i.e.* until after *c.* 37 ka cal BP), despite the fact that favorable environmental conditions for such an expansion may have existed previously (even if only for brief periods), as a result of the several colder spells recorded in different paleoclimate proxies after the time of their first arrival in Cantabria and the eastern Pyrenees, *c.* 42 ka cal BP.

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16. Neanderthals and Cro-Magnons in Northern Spain: Ongoing Work at the Sopeña Rock-Shelter (Asturias, Spain)

Ana C. Pinto-Llona, Geoffrey Clark, Alexandra Miller and Kaye Reed

Abstract

Possible relationships between the hominids involved in the Middle to early Upper Paleolithic transition in northern Iberia are hotly debated, and much of that debate focuses on a small number of controversially-dated sites, most of them excavated during the early decades of the 20th century. Here we describe the Sopeña rock shelter, a new archaeological site in eastern Asturias, where a 2002 test trench has revealed a sequence of at least 16 well-stratified levels spanning this critical interval in human evolution. The issues posed by the Middle to Upper Paleolithic transition in the region are summarized briefly, and preliminary results and new ^{14}C AMS dates are presented. The application of new technologies and methods at sites with high contextual integrity like Sopeña offer the possibility of adding significantly to our understanding of these issues.

The Late Middle to Early Upper Paleolithic Transition in Western Europe

It has long been recognized that, around 40,000 years ago, the west European archaeological record shows an increase in the rate of technological innovation manifest in the production of bone and antler tools and other artifacts, personal ornaments, portable and parietal art, sculpture, musical instruments and blade technologies. These innovations appear to suggest that significant changes in human behavior took place over the Middle-to-Upper Paleolithic transition interval, generally reckoned to correspond to the ten millennia on either side of 40 kya. While the changes themselves appear real enough, what is causing them to occur remains the subject of lively (and sometimes heated) discussion.

Some suggest that the changes represent the entry and spread throughout Europe of anatomically and behaviorally modern *Homo sapiens* – which in turn influenced existing Neanderthal technologies (*e.g.* Mellars 1989, 1996; Harrold 1989; Kozlowski and Otte 2000). Others think that newly arrived *Homo sapiens* copied the Upper Paleolithic transitional technologies (*e.g.* and especially the Châtelperronian) developed earlier and independently by Neanderthals, or that the industries themselves are not demonstrably 'hominid specific' (Clark and Lindly 1989 a, b; Rigaud 1989; Otte and Keeley 1990; Clark 1997; Straus 1995, 1997;

d’Errico *et al.* 1998; Zilhão and d’Errico 1999). Neanderthals are suggested as the makers of the Early Aurignacian as in El Castillo (northern Spain, Cabrera *et al.* 2000, 2001) and Vindija (Croatia) (Karavanic 1995). It has also been suggested that there were direct exchanges of objects between Mousterian and Aurignacian populations at Vindija (Karavanic and Smith 1998).

At the base of these discussions are dating and calibration issues that make it difficult to accurately pinpoint the transition interval (van Andel 1998; van der Plitcht 1999; van Andel and Davies 2003). Radiocarbon becomes highly susceptible to contamination for samples older than *c.* 35 kya, at which point $<1\%$ of the initial ^{14}C activity remains and the introduced error may be of the same order of magnitude as the time scale of the transition (Schwarcz 1997). Also, radiocarbon dates near 40 kyr bp appear to be 1.5–3 kyr younger than more accurate but less generally applicable uranium series determinations (*e.g.* Bischoff *et al.* 1994).

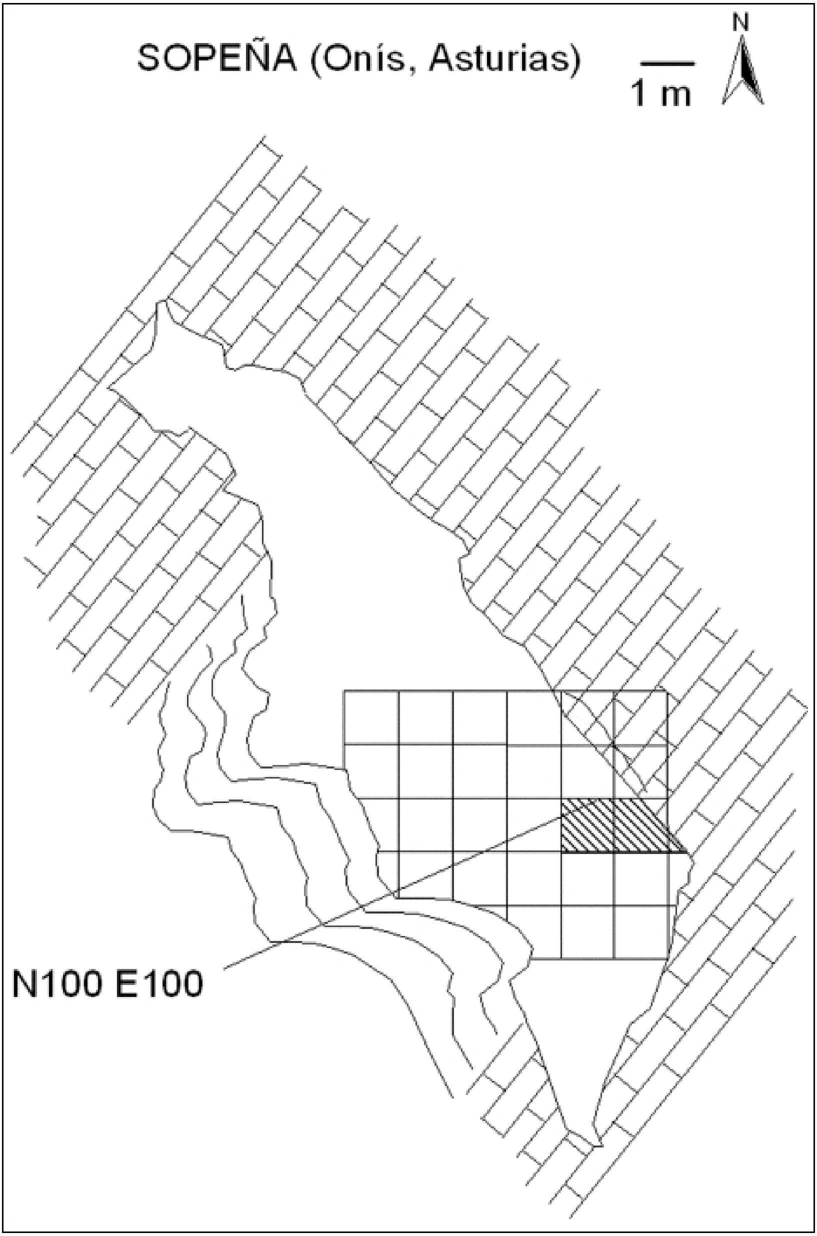


Figure 16.1. Plan of the site. Shaded in grey, the test excavation. The grid indicates area currently under excavation.

In addition to the dating problems, are the issues of how precisely to define the transition archaeologically (Clark 1999) and what behavioral and/or cognitive changes (if any) accompanied the observed phenomena; whether Neanderthals, modern humans or both, and to what degree, were involved in this phenomenon; whether it was a cultural and/or genetic replacement or, as Straus (1992) argued, it was a temporal and spatial mosaic of different adaptations.

Further obscurity is added by the fact that human remains pertaining to this time range are very scarce. It is thought that European Mousterian industries were exclusively the work of Neanderthals (*e.g.* Churchill and Smith 2000; Bolus and Conard 2001). Most of the transitional industries (*e.g.* Châtelperronian, Szeletian, Uluzzian) appear to be technologically rooted in the local Mousterian, thus were the work of Neanderthals. Although it seems certain that modern humans were established in Europe by *c.* 32 kyr bp, they could have been present there as early as *c.* 40 kyr bp, but the few human fossils dated to 45–35 kyr bp do not allow for general correlations of particular archaeological industries with particular hominine types.

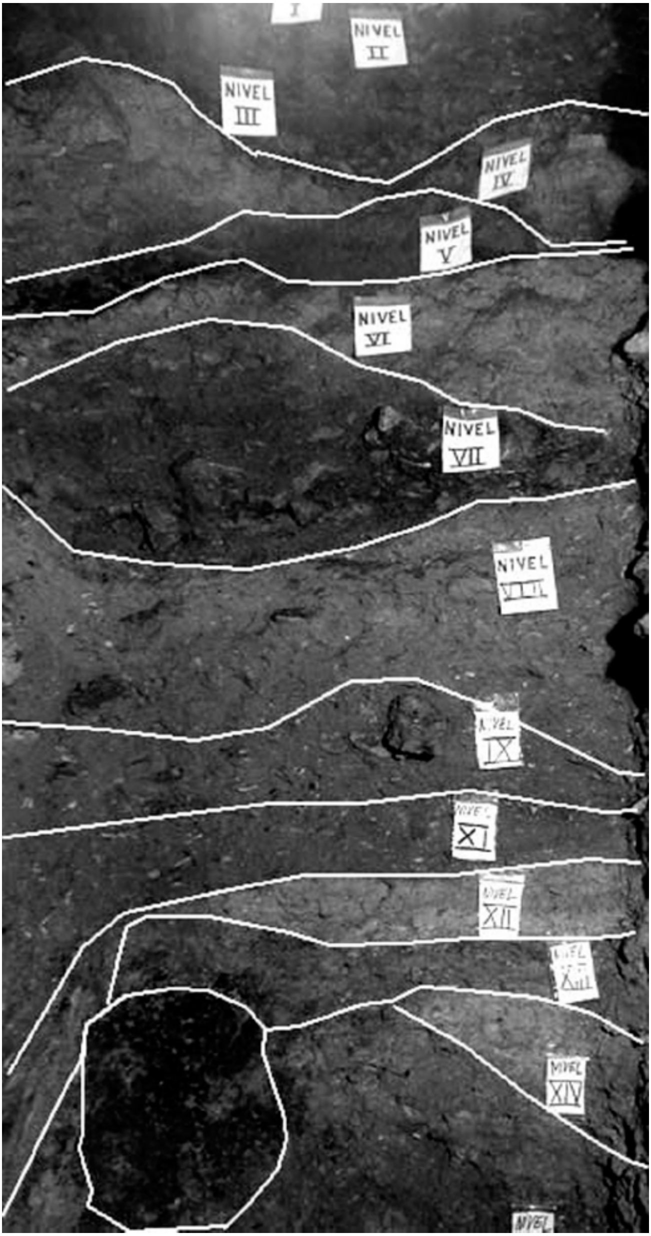
The Transition in the Iberian Peninsula

As elsewhere, much debate surrounds some dates published for the MP–EUP transition in Spain. Several works offer very early dates, *circa* 40 kyr BP, for the Aurignacian in the north (*e.g.* Bischoff *et al.* 1989; Cabrera and Bischoff 1989; Straus 1992, 1997; Bischoff *et al.* 1994; Fortea Pérez 1995, 1999). Others offer very recent dates for allegedly Mousterian sites in southern Spain (Hublin *et al.* 1995, 1996). Some propose an abrupt replacement in the north, as at l'Arbreda in Catalunya (*e.g.* Bischoff *et al.* 1989), others suggest that the early Upper Paleolithic (EUP) was a local, *in situ* development (*e.g.* Straus 1992), and still others propose that the EUP originated in the eastern Mediterranean and spread across Europe from east to west in a progressive wave (*e.g.* Otte and Keeley 1990; *cf.* Clark and Lindly 1991). The debate on the transition in northern Spain turns on a handful of sites, some of them originally excavated in the early part of the last century (*e.g.* Arbreda, El Castillo). In addition, significant finds were sometimes lost during the Spanish Civil War (*e.g.* human remains from El Castillo), recovery methods were often inadequate or biased in other ways, and publication was frequently insufficient. Recent work explores the remaining sequence at El Castillo (Cabrera *et al.* 2001) and witness sections at Abric Romaní have been dated (Bischoff *et al.* 1994). There may also be transitional layers in new sites currently being investigated and analyzed with modern techniques (*e.g.* El Mirón, Straus and González Morales 2003).

The investigation with modern techniques of the rare sites with well stratified cultural deposits spanning the MP-EUP Transition will shed light on these issues, allowing us to improve our understanding of the actors, circumstances and behavioral shifts involved, and to help clarify the debated chronology of the transition interval in northern Spain.

Sopeña and its Regional Setting

North-central Spain comprises a massive series of Cretaceous limestones most evident in the Picos de Europa, a mountain chain that parallels the coast in the southern parts of Asturias and Cantabria. Sopeña is a rock-shelter in in eastern Asturias at c. 450 m above sea level and c. 250 m above the valley of the Rio Güeña, which it overlooks. The shelter is approximately 60 m^2, it opens to the southwest, and affords an unobstructed view of the adjacent valleys to the west. Figure 16.1 shows the surface currently in excavation, and the shaded area is the test excavation.


I
NIVEL II
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NIVEL VI
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NIVEL VIII
NIVEL IX
NIVEL XI
NIVEL XII
NIVEL XIII
NIVEL XIV
NIVEL

Figure 16.2. Stratigraphic sequence in the west wall of the 2002 test excavation.

In 2002 we excavated a 2 × 1 m. test trench, reaching a depth of *c.* 3 m. below *datum* without encountering bedrock. Sixteen well stratified and very fertile archaeological levels were exposed in the walls of the trench, ascribed to the late Middle and early Upper Paleolithic. The west section of the test is given in Figure 16.2. Finds are very abundant and well preserved, with faunal remains outnumbering lithic remains by a ratio of 3:1. Regarding the fauna, a very preliminary overview shows that most of the assemblage throughout the sequence is formed by shaft fragments, and epiphyses and teeth are quite rare, thus limiting taxonomic identification. Species present (Table 16.1) in the levels analyzed thus far are the familiar ones for this time span and geographic area (Table 16.1). The levels that have a larger number of finds also offer (as expected) greater taxonomic variety. Carnivores seem to be more frequent in the upper levels, particularly in Level III, and their possible contribution to the faunal composition of the site must be analyzed and accounted for prior to making inferences about the human behavioral component.

Table 16.1. Preliminary attribution to taxa in some levels

	I	II	III	IV	V	VI	VII	VIII
Bos primigenius/Bison (auroch or bison)	X	X	X	Artiodactyls	Artiodactyls	Artiodactyls		Artiodactyls
Capra sp. (ibex)	X	X	X			X		X
Rupicapra rupicapra (chamois)	X	X	X		X	X	X	X
Cervus elaphus (red deer)	X	X	X		X		X	X
Megaloceros giganteus (giant Irish elk)		X						X
Capreolus capreolus (roe deer)	X							
Rhinocerotidae	X							
Equus sp. (horse)			X			X	Perissodactyls	
Canis lupus (wolf)			X				X	Carnivora
Viverridae	X							
Mustelidae		X	X					
Large felids		X	X					
Hyaena			X					
Birds		X	X			X		X
Fish			X					

The Early Upper Paleolithic Sequence (Levels I–XI)

One Gravette point from Level I, another from Level III and some fragmentary bone points and antler awls in Levels III, V and VII, as well as a keeled endscraper in Level VII suggest assignment of the three uppermost levels to the Gravettian, and Levels IV–XI to the (so far undifferentiated) EUP. One uncalibrated ^{14}C AMS date on a bone from Level XI (32,870 ± 530 BP [Beta 171157]) marks the earliest EUP at Sopeña. Levels III, V and VII are almost black, with much charcoal and burnt bone; hearths, ochre and quartz crystals are well-documented. Although of limited extent, Levels I–XI yielded 3476 stone artifacts and 104 retouched pieces, suggesting a very considerable cultural component in the formation of at least some of these deposits.

As for the raw materials, the same four types are represented throughout the EUP sequence (Table 16.2). In descending order of importance, they are, by weight, (1) quartzites, (2) limestones, (3) flints and cherts, and (4) quartz. In Levels I–XI, 50.7% of the artifacts are made on quartzite, 23.6% on various kinds of limestone, 20.3% on flints and cherts, and 5.4% on quartz. Although there are marked differences in the relative frequencies of retouched pieces, and in some debitage categories, there is little change over time in the ratios of raw material (see below). The fundamental raw material dichotomy between relatively large retouched pieces like denticulates and sidescrapers made on quartzite flakes, and smaller, relatively delicate retouched pieces like backed bladelets made on flints and cherts (Clark 1989), is also apparent in the Sopeña test excavation. About 4% of the Level I–XI total comprises heavy duty tools like choppers, chopping tools and hammerstones, all of them made on quartzite pebbles and cobbles (Figures 16.3, 16.4).

Debitage (Figure 16.5) was classified according to 25 categories developed by Clark in order to monitor the various phases in the reduction process, which – in turn – should allow for some fundamental distinctions between whether primary reduction was taking place in any given level, compared with secondary retouching, which indicates weapon and tool manufacture and maintenance. Cores were also classified according to nine categories, and were scored as ‘exhausted’ if it appeared that no additional flakes could be detached from them (Clark *et al.* 1986). The debitage and core data from the 2002 test are summarized in Figure 16.5. Both are *en bloc* comparisons of the Upper Paleolithic with the Middle Paleolithic levels.

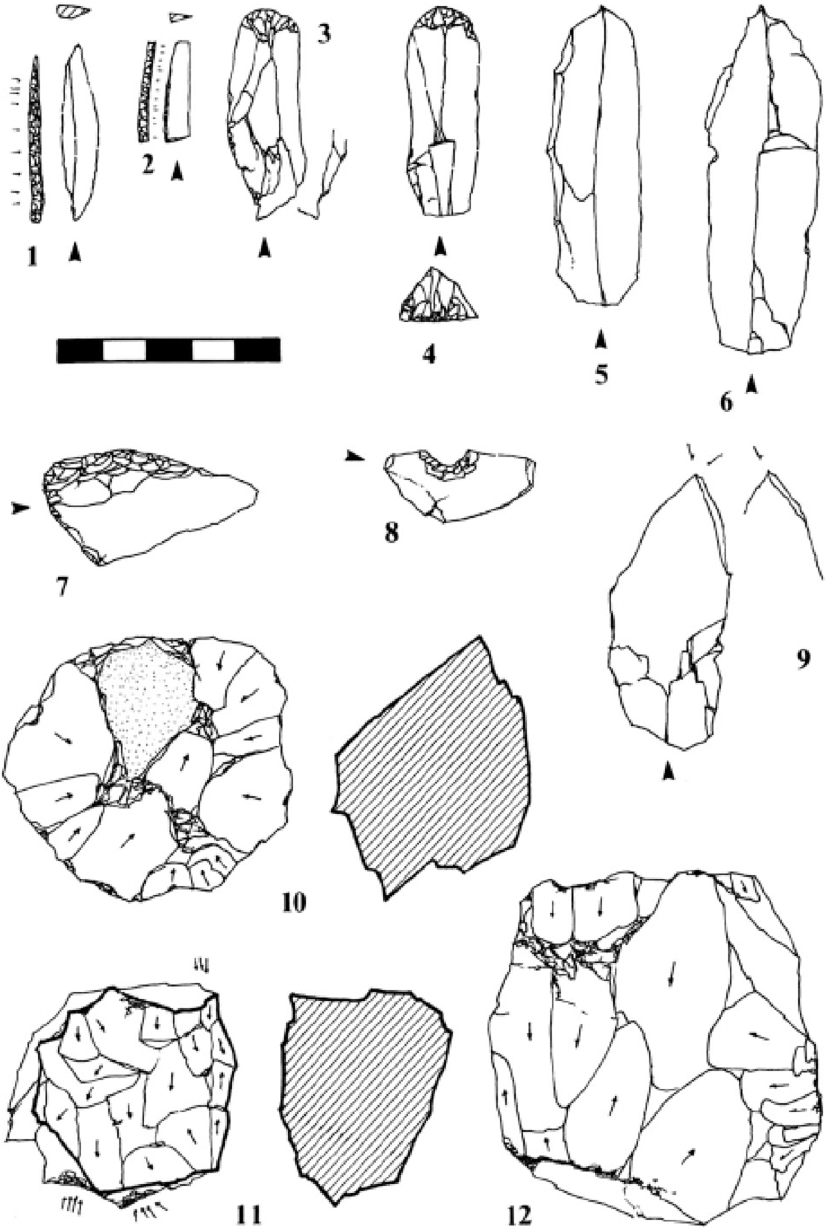

Figure 16.3. The Upper Paleolithic of Sopeña. Levels I–III. 1. Gravettian point (flint, J6–I), 2. backed bladelet (flint, J6–I), 3. endscraper/perforator on a blade (flint, J6–I), 4. endscraper on a thick blade (flint, J6–II), 5. and 6. 1st order blades (limestone, JG-III), 7. sidescraper (quartzite, J6–III), 8. notched flake (limestone, J6–III), 9. dihedral burin (limestone, J6–III), 10. disc core (limestone, J6–III), 11. mixed flake/blade core with multiple platforms (flint, J6–III), 12. mixed core with multiple platforms (limestone, J6–II). Scale = 5 cm.

The debitage fraction in Levels I–XI comprises 97% of the artifact total, and is dominated by plain and trimming flakes (30% and 25% respectively), suggesting considerable secondary reduction. Shatter – indicative of primary reduction – accounts for 28% of the debitage total, however, and there are also substantial numbers of cortical flakes, single and multiple platform flake and blade cores, and core renewal flakes. Although not numerous, blades and bladelets are more common in Levels I–XI than they are in Levels XII–XVI. Nevertheless, the debitage frequencies in the two major analytical units are strikingly similar.

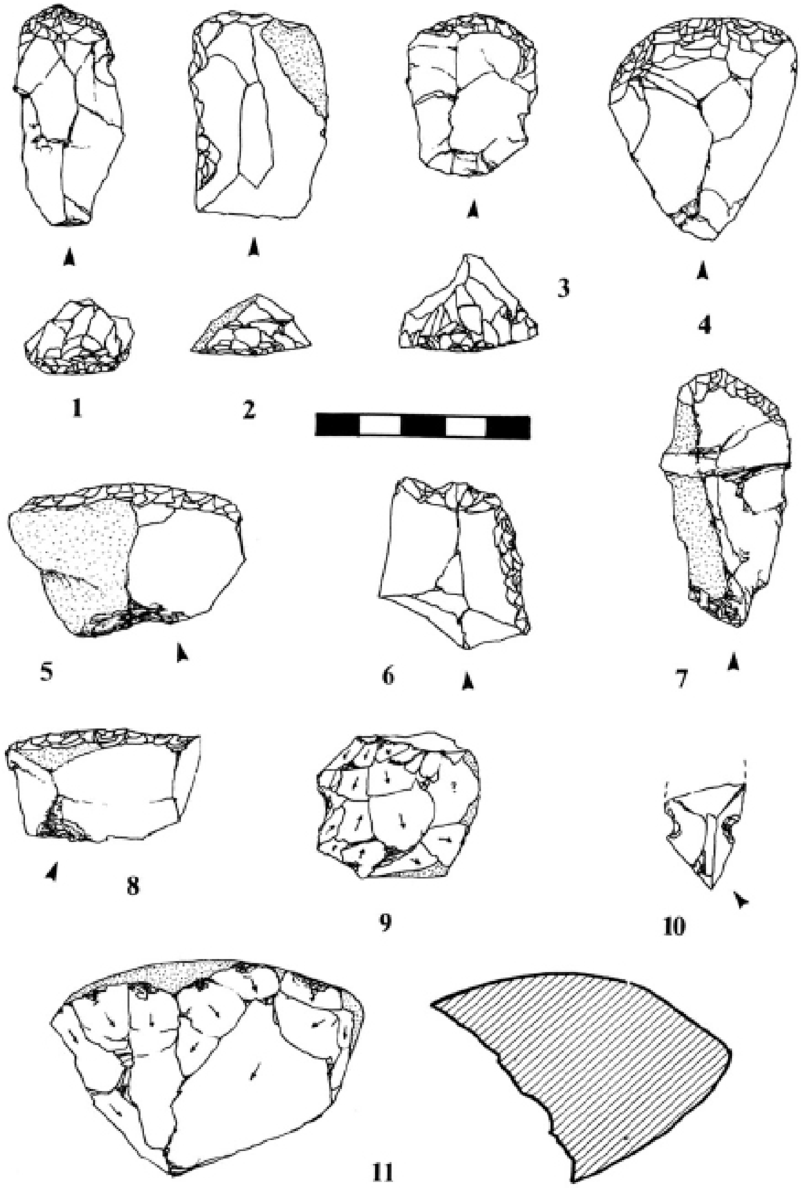

Figure 16.4. The Upper Palaeolithic of Sopeña. Levels IV–XI. 1. endscraper on a blade (quartzite, J6–IX), 2. endscraper/CRP-1 (quartzite, J6–V), 3. keeled endscraper on a flake (flint, J6–VII, 4. fan-shaped endscraper on a flake (quartzite, I6–VII), 5. endscraper on a flake (quartzite, I6–VII), 6. endscraper/sidescraper on a flake (quartzite, J6–IX), 7. endscraper on a blade (quartzite, J6–VII), 8. sidescraper on a flake (quartzite, K6–X), 9. exhausted multiplatform core (quartzite, K6–X), 10. flake with opposed notches (flint, J6–V), 11. single platform core and/or 'chopper' (quartzite, I6–IV). Scale = 5 cm.

Retouched pieces accounted for 3% of the Level I–XI artifact total, which falls within the range typical of most European Upper Paleolithic assemblages (2–5%). Although there were substantial numbers of generic tools like notches and denticulates (19%), endscrapers and burins accounted for 14% and 13% of the retouched tools, significantly higher than in Mousterian Levels XII–XVI. Retouched blades and *pièces esquillées* were also more prevalent in these Upper Paleolithic deposits than in the Middle Paleolithic sequence. However, sidescrapers made on quartzite flakes and closely resembling their Mousterian counterparts account for 10% of the Upper Paleolithic retouched tool total.

Table 16.2. Sopeña Test Excavation: Raw Material Types – Weight in Grams.

	Quartzite		*Flint*		*Limestones*		*Quartz*	
Levels I–XI (EUP)	12501	.507	4996	.203	5831	.236	1326	.054
Levels XII–XVI (MP)	4382	.728	539	.090	1061	.176	33	.006

Table 16.3. Sopeña Test Excavation: Cores and Debitage – Counts.

	Levels I to XI Early Upper Paleolithic		*Levels XII to XVI Middle Paleolithic*		*Total*
	n	%	*n*	%	*N*
Total Lithics	3476	85.2	604	14.8	4080
Total Debitage	3372	85.8	559	14.2	3931
Total Flake Debitage [1]	2012	82.6	424	17.4	2436
Total Blade Debitage	183	88.8	23	11.2	206
Total Bladelets	102	95.3	5	04.7	107
Total Cortical Flakes	284	79.3	74	20.7	358
Total Cortical Blades	21	75.0	7	25.0	28
Total Shatter [2]	948	28.1	82	13.6	1030
Total Cores	131	85.6	22	14.4	153
Cores/Total Lithics [3]		03.8		03.6	
Total Retouched Pieces	104	69.8	45	30.2	149
Retouched Pieces/Total Lithics [4]		03.0		07.4	

1. includes cortical flakes, plain flakes, trimming flakes, naturally backed flakes, core renewal flakes, and platform tablet flakes; excludes shatter (EUP, MP)
2. total shatter divided by total debitage
3. total cores divided by total lithics (EUP, MP)
4. total retouched pieces divided by total lithics (EUP, MP)

The Middle Paleolithic Sequence (Levels XII–XVI)

The transition to the Middle Paleolithic in Level XII is marked by a change in the retouched component of the lithic assemblage, and stratigraphically by a change in color and texture from overlying Level XI. A typical Mousterian point was recovered from Level XII, and sidescrapers are prevalent throughout it and in the underlying levels (especially in Levels XIV, XV). We have only one ^{14}C AMS date on a tooth from Level XII of 38,630 ± 800 uncal. (Beta 198146).

Levels XII–XVI yielded 604 stone artifacts and 45 retouched pieces. The smaller number of pieces (604 *vs* 3476) and lower mean level counts (121 *vs* 225) and weights (1203 *vs* 2241 gms) are usual for Mousterian deposits in northern Spain, and suggest a more ephemeral Mousterian use – on average – of caves and rockshelters than is typical for the Upper Paleolithic. This could mean that Mousterian populations were generally smaller than those of the Upper Paleolithic, and/or that they were spending less time in caves and rockshelters, as has been suggested by a number of authors (*e.g.* Jelinek 1988, 1994) although further research will shed more light on this.

Raw material in the Mousterian levels is dominated by the same fine-to-medium grained gray quartzite found in the upper part of the sequence. Although a more in depth analysis of these is pending, we can say now that in Levels XII–XVI, 72.8% of the artifacts by weight are made on quartzite, 17.6% on limestone and other materials, 9% on flints and cherts, and 0.6% on quartz. Quartzite is even more important than in the Upper Paleolithic levels (50.7%), but quartz drops out of the picture almost entirely. By far the most important levels in the Mousterian sequence are Levels XIV and XV, which account for 45.5%, by weight, of the worked stone recovered from the test.

Despite significant differences in the retouched tools, the debitage fraction (Figure 16.5) from Levels XII–XVI closely resembles that from Levels I–XI (Table 16.2). There is more evidence for primary reduction in that primary and secondary decortication flakes are slightly more numerous, accounting for 13% of the debitage total. Plain flakes are significantly more prevalent, accounting for 40% of the debitage total (*vs* 27% in the Upper Paleolithic levels). The only disk cores in the sequence come from the Upper Paleolithic levels, however. In keeping with evidence from El Castillo (Cabrera 1984), El Pendo (Freeman 1980) and Cueva Morín (Freeman 1971, 1973), there is little evidence of Levallois technique, perhaps because of raw material constraints. In other words, the main raw material type consists of quartzite pebbles and cobbles, whereas good flint in large 'packages' is practically non-existent in northern Spain.

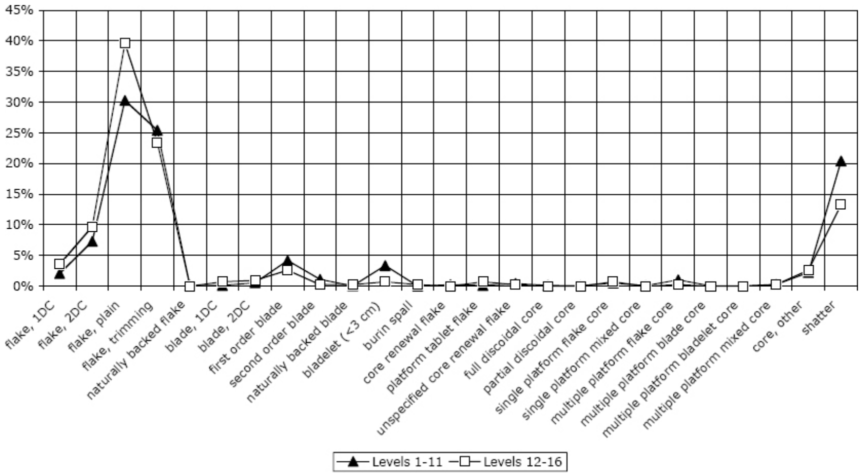

Figure 16.5. Sopeña – Comparison of Middle and Upper Paleolithic Debitage.

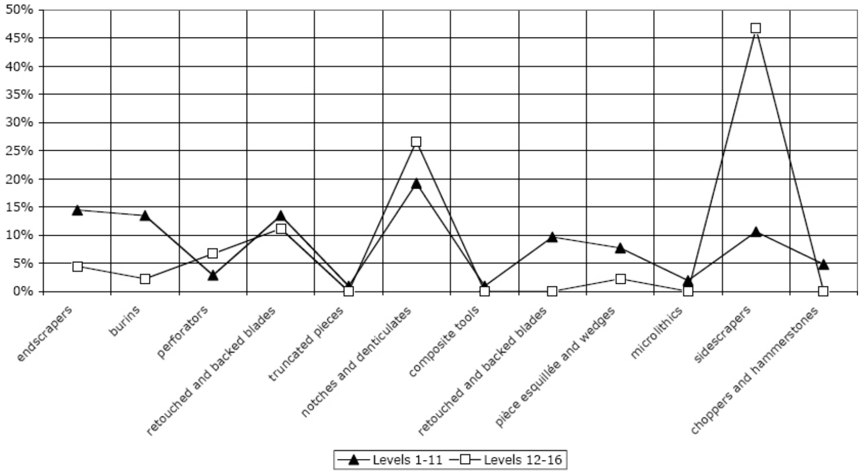

Figure 16.6. Sopeña – Comparison of Middle and Upper Paleolithic Retouched Pieces.

Retouched pieces accounted for 7.4% of the Level XII–XVI artifact total, which is a little higher than the average for the regional Mousterian, and more than twice as high as the corresponding statistic (3%) for Levels I–XI (Table 16.2, Figure 16.6). Forty-seven percent of the retouched total consists of sidescrapers made on quartzite flakes. Notches and denticulates account for an additional 27%, and there is a modest representation (11%) of retouched flakes. Classic Upper Paleolithic tools like endscrapers and burins are rare, lending additional confidence that the basic cultural stratigraphy exposed in the test is essentially correct. Sidescrapers are generally unilateral, convex and steeply retouched, conforming to the Quina variant of the Charentian facies, as defined by Bordes (Figure 16.7). Although this observation carries with it no chronological or behavioral implications, it is interesting to note that Cabrera *et al.* (1996) also remark on the prevalence of Quina-type Mousterian industries at El Castillo and in Cataluña. They point out that, at present, no Ferrassie-type Charentian facies nor MTA Mousterian sites or levels are known with certainty from northern Spain, and that the most prevalent Mousterian facies are the Denticulate variant, best represented at Cueva Morín, and the Typical Mousterian, regarded by many as a 'catch-all' category which lacks an adequate definition. Unlike Morín, however, where ophite cleavers are well-represented in Mousterian deposits (Freeman 1971), the Sopeña test did not yield any cleavers, nor the characteristic transverse flakes detached to produce them. In a recent and comprehensive empirical study, Freeman (1994) questions the technological and typological discreteness of the Bordesian facies in Cantabria and comes to the conclusion that the facies are arbitrary constructs, and that formal variation is more or less continuous across the 'key' north Spanish Mousterian sites (*i.e.* El Castillo, Cueva Morín, El Pendo, La Flecha).

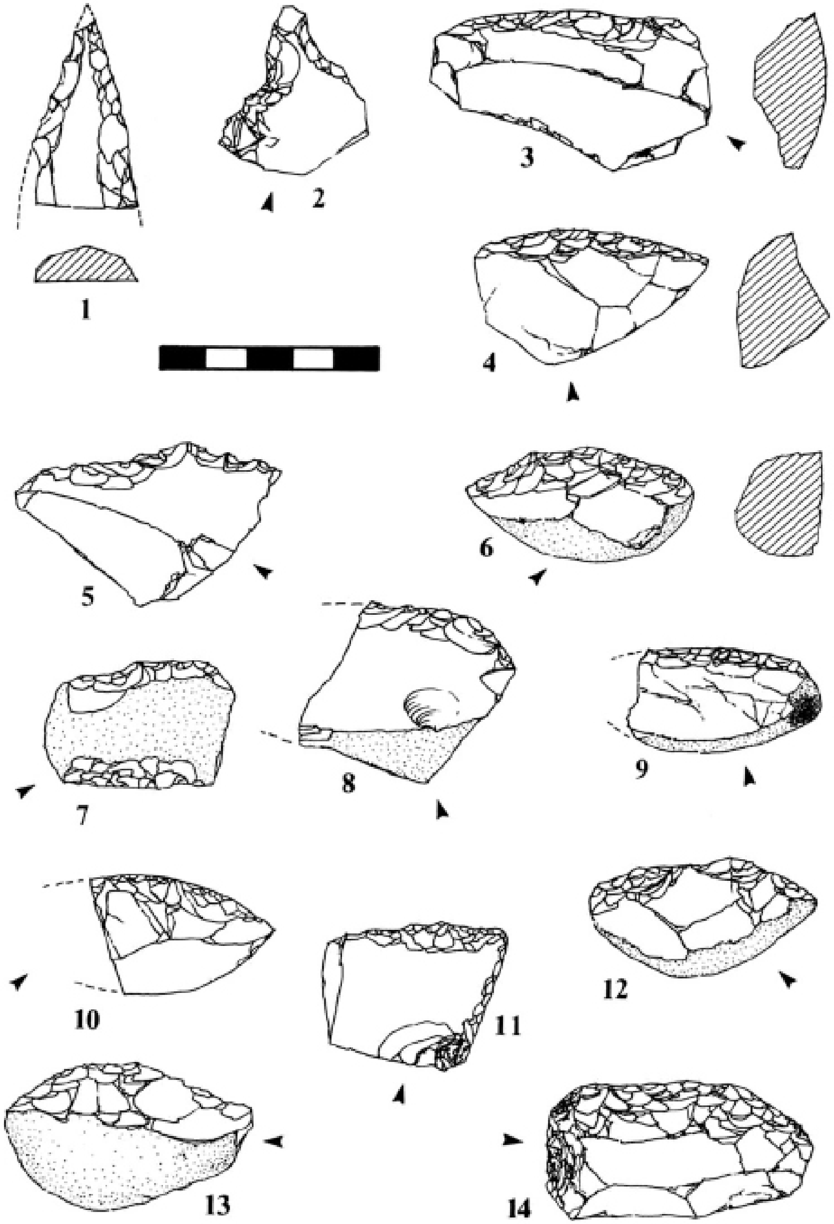

Figure 16.7. Sopeña Middle Paleolithic Levels XII-XVI. 1. Mousterian point (I6–XII), 2. notch/bec (I6–XIV/XV), 3. and 4. convex sidescrapers (K6–XV), 5. denticulate (K6–XV), 6. convex sidescraper (J6–XV), 7. double sidescraper (I6–XIV/XV), 8. convex sidescraper fragment (I6, XV/XVI), 9. straight sidescraper with localized battering on one end (K6–XV), 10. convex sidescraper fragment (K6–XV), 11. double convergent sidescraper (K6–XV), 12. and 13. convex sidescrapers (J6–XIV/XV), 14. straight sidescraper (I6–XIV/XV). All pieces shown are quartzite.

Scale = 5 cm.

Concluding Remarks

New data and recent analyses from Iberian sites that appear to date to the Middle-Upper Paleolithic transition suggest a very early arrival of Upper Paleolithic technologies in the north – seemingly precluding an Early Upper Paleolithic diffusion from east to west (*e.g.* Clark and Lindly 1991). This, and the very late survival of Neanderthal associated Middle Paleolithic technologies in the south, continue to make the Iberian Peninsula a major focus of research on modern human origins. In this contex, Sopeña is relevant because of its long and probably intact sequence of Middle and Early Upper Paleolithic deposits. Clearly, we need more dates. Although there is a long hiatus between the dates from levels XI and XII, both these levels are of considerable thickness. However, no Châtelperronian diagnostics have been identified from the 2002 test. For the present, we can say that Sopeña has a long Gravettian and Early Upper Paleolithic sequence in Levels I–XI, postdating 33 ky bp (uncalibrated). The EUP levels overlie at least six well-preserved Mousterian levels, although the bottom of the cultural deposits in the cave has not so far been reached. Our top priority is to get more radiocarbon and ESR determinations in order to be able to establish an absolute chronology of the site. With its abundant and well preserved lithics and fauna, excavated, recorded and analyzed with modern methods, we hope that on-going research at Sopeña will shed light on the important behavioral changes that separate us from our archaic predecessors.

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17. What's in a Name? Observations on the Compositional Integrity of the Aurignacian

Geoffrey A. Clark and Julien Riel-Salvatore

Abstract

No other analytical unit is so important to understanding our biological and cultural origins as the Aurignacian, taken by many to signify the physical presence of H. sapiens in western Eurasia. Following a brief summary of current views of the archaeology of modern human origins, we outline the history of the Aurignacian since it was first defined by Lartet and Christy at the cave of Aurignac in the 1860s. For the Aurignacian to have heuristic validity, it must share a number of defining characteristics that co-occur systematically across space and time. To test its compositional integrity, we examine data from 52 levels identified as Aurignacian by their excavators. Classical indicators of the French Aurignacian are also reviewed and used to contextualize data from other regions, allowing us to assess whether or not the Aurignacian can be considered a single, coherent archaeological entity. We conclude with some observations on the nature of Paleolithic analytical units.

The Archaeology of Modern Human Origins

The question of our origins continues to be one of the most contentious, absorbing and intellectually stimulating debates in paleoanthropology, combining archaeology, human paleontology, molecular biology and evolutionary ecology to address the multiple dimensions of this issue (Clark 1999). Recent work has emphasized the importance of regions other than western Eurasia, notably Africa (McBrearty and Brooks 2000; Henshilwood and Marean 2003) and east Asia (Pope 1997; Wu 2004) to shed light on how *H. sapiens* came to be the only hominin on the planet. However, one of the enduring aspects of the modern human origins (MHO) debate is the fate of the Neanderthals (see, *e.g.*, papers in Bar-Yosef and Pilbeam 2000; Zilhão and d'Errico 2003a), an issue apparently confined to the west Eurasian 'heartland' where the controversy first arose. At present, scholars involved in the archaeological aspects of the debate tend to be polarized between those who see in the archaeological record evidence for a temporal and spatial mosaic of behavioral continuity across the Middle-Upper Paleolithic transition (the 10 millennia bracketing 40 kyr bp) (*e.g.* Clark 2001, 2002a; Marks 2003; Straus 2003), and those who interpret the same data as a pattern of relatively abrupt change documenting the earliest evidence for behavioral modernity (*e.g.* Mellars 1996, 2004, 2005; Bar-Yosef 2002, 2003). Evidence for or against abrupt change is often linked implicitly to evidence for or against a biological replacement of Neanderthals by modern humans – this despite a paucity of diagnostic hominin remains dating to the transition interval (Churchill and Smith 2000). A third position – the 'indigenist' model – claims that Neanderthals making Châtelperronian industries achieved a modern (or at least an Upper Paleolithic) level of cultural development earlier than, and independent of, modern humans making Aurignacian industries (d'Errico *et al.* 1998; Zilhão and d'Errico 1999, 2000, 2003b), thus uncoupling the behavioral and biological aspects of the MHO debate seen as inextricably linked by many workers. Because Neanderthals disappear over a long interval after the appearance of the Aurignacian in western Eurasia, this model is in fact a variation on the replacement position (Harrold and Otte 2001).

What is infrequently emphasized is that *all* these models posit that Neanderthals disappeared from the European record sometime after 30 kya, and that what really is at issue is *how* they disappeared (Wolpoff *et al.* 2004). In this respect, the notion of 'transitional' industries – those that display technological and typological combinations of Middle and Upper Paleolithic diagnostics – is central to all three models. The 'transitional industry' concept mainly came to be used after 1978, when a Neanderthal skeleton was discovered in association with a Châtelperronian industry at the site of Saint-Césaire, in the Charente (Lévêque *et al.* 1993). Thereafter, the Aurignacian came to be considered the first 'truly Upper Paleolithic' industry by virtue of its presumed association with modern humans, while most other early Upper Paleolithic industries stratified below it came to be considered the work of Neanderthals and were redesignated 'transitional' (Rigaud 2000).

The main conceptual problem with transitional industries is that they did not, and still do not, comfortably fit within the traditional analytical schemes widely used in paleolithic research (Kuhn 2003; see also papers in Marks and Chabai 1998, Chabai and Monigal 1999, Brantingham *et al.* 2004; Chabai *et al.* 2004). The reason behind this is straightforward: for the Eurasian Paleolithic, two different typological systems have been used to describe the morphological variation in Middle and Upper Paleolithic retouched stone artifacts (*i.e.* Bordes 1953, 1961 for the Middle Paleolithic, de Sonneville-Bordes and Perrot 1953, 1954, 1955, 1956 for the Upper Paleolithic). This fundamental divide exaggerates differences that might otherwise appear clinal or mosaic and, because interpretations of Paleolithic behavioral variability are most commonly based on stone tool frequency distributions, this dichotomy effectively establishes (and reinforces) a *de facto* behavioral distinction between the two periods (Clark 1997, 2002a; Blades 2001; Marks *et al.* 2001; Riel-Salvatore and Clark 2001; Riel-Salvatore and Barton 2004). In fact, studies that have employed a single method to measure lithic variability across the transition strongly suggest that modal shifts in lithic technology do not correspond with the traditional Middle-Upper Paleolithic boundary at *c.* 40 kyr bp (*e.g.* Sackett 1988, 1997; Simek and Price 1990; Grayson and Cole 1998; Riel-Salvatore and Barton 2004).

Trait List Approaches and Behavioral Modernity

Many MHO researchers consider archaeological data to be of secondary importance in the evaluation of models based primarily on skeletal evidence

(Marks 2003), and replacement advocates thus tend to emphasize *differences* between the Middle and the Upper Paleolithic archaeological records. These workers usually consider transitional industries a highly polymorphic 'Epi-Mousterian', with the connotation that, unlike the Aurignacian, they are not really 'Upper Paleolithic' (*e.g.* Howell 1999, but cf. d'Errico *et al.* 1998; Zilhão and d'Errico 2003b). In light of growing recognition of the limitations imposed on studies of lithic variability by the use of two typologies (*e.g.* Bisson 2000; Zilhão 2006), proponents of the replacement position argue that the Aurignacian is further characterized by a suite of distinctive features derived mainly from the archaeological records of southwestern France (*e.g.* Mellars 2004, 2005) and the Near East (*e.g.* Bar-Yosef 1994, 2002) that supposedly differentiate it from other EUP industries, and from the Mousterian. These are (1) a dominance of lamellar technologies, (2) more evidence for 'imposed form' and greater standardization of tool shapes, (3) the development of 'organic' technologies using bone, antler, ivory and shell; (4) a faster rate of technological change and more typological diversity, (5) the appearance of personal ornaments, (6) the development of portable and parietal 'art', (7) specialized and highly selective patterns in animal exploitation, and (8) more structured use of space. Combinations of these traits are equated with behavioral modernity and supposedly explain how anatomically modern humans of African origin were able to expand into Eurasia after *c.* 50 kya and displace Neanderthals from the niches they had occupied since the Middle Pleistocene (Bocquet-Appel and Demars 2000; Mellars 2000, 2005; Davies 2001).

The use of this trait list approach to define behavioral modernity has recently come under critical scrutiny. Some scholars have shown empirically that archaeological criteria invoked to identify behavioral modernity were derived inductively by highlighting differences between the Mousterian and the Aurignacian records, and arguing *ex post facto* that these differences must, therefore, be markers of behavioral modernity (*e.g.* Clark 1999, 2002b; Grayson and Delpech 2002). Others have pointed to implicit Eurocentric bias in these trait lists, and have underscored the problems inherent in using empirically-derived, context-specific criteria to define modern behavior (McBrearty and Brooks 2000; Henshilwood and Marean 2003). Recent reviews of the evidence also suggest that all the traits have much greater time-depth *throughout the Old World* than previously recognized (d'Errico 2003; d'Errico *et al.* 2003).

These problems with the trait list approach have spurred renewed interest in identifying subtle, previously unrecognized differences between Neanderthals and AMH based on re-examinations of their lithic assemblages, arguably the most abundant and durable aspect of the long interval (*c.* 150 ky) during which they supposedly coexisted. For example, by looking at blank production strategies, differentials in artifact curation, evidence for projectile weapon use, and raw material procurement patterns, John Shea (*e.g.* 2003) has used the Levantine Mousterian as a case study to show how superficially similar lithic industries associated with Neanderthals and AMH might indicate significant behavioral differences between the two hominin groups. These, and other studies (*e.g.* Marks and Freidel 1977; Barton 1988, 1998; Dibble 1995; Kuhn 1995; Riel-Salvatore and Barton 2004), have demonstrated that these relatively 'coarse-grained' dimensions of lithic technology can be used to reconstruct large-scale economic decisions, land-use patterns, mobility and foraging patterns, group composition, and aspects of intra-and intersite spatial organization. Taken together, these variables are sensitive indicators of adaptive differences between forager groups, especially when framed in their larger ecological contexts (Bamforth and Bleed 1997). Because these aspects of lithic variation are direct reflections of past behavior, they are better monitors of differences in adaptation than those used in trait list approaches that focus on the supposed artifact indicators of modernity (see Bisson 2000 for a thoughtful, balanced critique of Bordesian typological systematics).

Along with some others who approach the study of the Paleolithic from a broadly defined ecological perspective (*e.g.* Hayden 1993; Stiner 1994; Kuhn 1995; Straus 2003; see Winterhalder and Smith 2002 for an overview), we believe there are major differences in the conceptual frameworks that guide this kind of research, dependent, to a certain extent, on the intellectual traditions in which the archaeologists involved have received their training (*e.g.* Bar-Yosef 1991; Clark 1993; see papers in Straus 2002). These differences are thrown into sharp relief by different construals of the nature of the basic analytical units used in Eurasia to divide up the Paleolithic in space and time, and what those units are supposed to mean, or represent, in behavioral terms (cf. *e.g.* Neeley and Barton 1994; Goring-Morris 1996). In this chapter, we offer a preliminary empirical assessment of the compositional integrity of the most visible of these analytical units, the Aurignacian, taken by many to mark the appearance of modern humans in western Eurasia (*e.g.* Mellars 1992, 2004; Klein 2003).

The Compositional Integrity of the Aurignacian

For the Aurignacian to have heuristic validity, it must share a number of defining typological and technological features that co-occur consistently across space and time. To test its compositional integrity, we examine data from 52 Aurignacian layers at Kebara (Ziffer 1978), Hayonim (Belfer-Cohen and Bar-Yosef 1981), Warwasi (Olszewski 2001), Bacho Kiro (Kozlowski 1982, cf. Tsanova and Bordes 2003), Siuren I (Demidenko *et al.* 1998, 2001), Geißenklösterle (Hahn 1988), Trou Magrite (Straus and Otte 1995), Abri Pataud (Bricker *et al.* 1995; Brooks 1995), La Ferrassie (Delporte 1984), La Laouza (Bazile 1981), Fumane (Bartolomei *et al.* 1992), Riparo Mochi (Kuhn and Stiner 1998), Castelcivita (Gambassini 1997), El Castillo (Cabrera Valdés 1984), Chainça (Thacker 2001), and Cueva Morín (González Echegaray 1971). All sites are compared to one another on the basis of (1) relative frequencies of endscrapers, burins, and Dufour bladelets; (2) aspects of technology that monitor the prevalence of lamellar blanks (blades, bladelets), and debitage characteristics, and (3) observations about organic technologies, 'art', and personal adornment. Indicators of the classic French Aurignacian are reviewed and are used as a yardstick to contextualize data from other regions, allowing for quantitative assessment of whether or not the Aurignacian can be considered a single, coherent entity, suitable for use as an analytical device. We close with some observations on the problematic nature of 'historicity' (*i.e.* treating pattern and process in the remote past as if they were analogous to patterns and processes known from recent historical contexts), and some remarks on the role of formal convergence in lithic technology (Clark 2002a).

A Brief History of the French Aurignacian

After it was first defined at Aurignac by Lartet, de Mortillet and their contemporaries in the last quarter of the 19th century, the Aurignacian was reassessed by Breuil (*e.g.* 1912) to account for the discoveries of Piette and others in the 1890s. On the basis of characteristic typological features, Breuil created a unilineal scheme that divided the Aurignacian into three chronological subdivisions (Lower, Middle, Upper) with the latest supposedly allochthonous, unrelated to the others. In the 1930s, Peyrony (1933) revised Breuil's scheme based on his work at La Ferrassie, creating a 'parallel-phylum' model in which Breuil's Lower and Upper Aurignacian were reassigned to a separate 'Perigordian culture' (eventually divided on typological criteria into six phases). Breuil's Middle Aurignacian was retained and divided into five phases. Shortly thereafter, Garrod (1938) proposed that Peyrony's Lower Perigordian be redesignated the Châtelperronian and his Upper Perigordian the Gravettian, changes predicated on a supposed lack of phylogenetic relationship between the former and the latter. These ideas were contested in various segments of the French research tradition over the 1940s and 1950s, with the status of Peyrony's Pergordian II, which had a lot of backed bladelets, being particularly controversial. In the 1950s, de Sonneville-Bordes (*e.g.* 1958) and others argued that the Perigordian II showed greater similarity with the Aurignacian than with the Perigordian, and should therefore be extracted from its 'parent culture' and reassigned to the Aurignacian phylum. In the era of supposedly time-sensitive stylistic marker types, and in the absence of radiometric dates, this earliest Aurignacian phase was thought to pre-date Aurignacian I because of its stratigraphic position relative to the latter at sites like La Ferrassie. It was later christened Aurignacian 0 by Delporte (1968, 60). Despite the use of different typological systems (*i.e.* de Sonneville-Bordes and Perrot, Laplace, Hours, idiosyncratic) in different parts of Europe (*e.g.* France, Italy) and west Asia (*e.g.* the Levant, Zagros Mountains), there is a general impression that the earliest Aurignacian (= 0, I; Laplace's 'Proto-Aurignacian') is characterized by low tool-type diversity, a prevalence of Dufour bladelets, and very few bone tools and examples of 'art'. The modern view retains the notion of separate, penecontemporaneous 'phyla', although the credibility (and reality) of the various Aurignacian and Perigordian subdivisions continues to be debated, as does their behavioral meaning. A good synopsis of the history of Aurignacian research is given by Davies (2001, 195–201; see also Davies 1999).

The Irreducible Aurignacian

The Aurignacian is defined, first and foremost, by a set of supposedly diagnostic, allegedly time-sensitive 'index fossil' tool types (Table 17.1). The earliest Aurignacian assemblages are supposedly rather meagre overall, but have substantial numbers of Dufour bladelets and carinated endscapers. Aurignacian I is defined by the occurrence of split-based bone points, numerous carinated and nosed scapers, and by 'Aurignacian' and strangled blades. Aurignacian II is marked by flattened, lozenge-shaped bone points and large numbers of *busqué* burins, Aurignacian III by oval-sectioned lozenge-shaped bone and antler points, and the appearance of Vachons-type burins (which differ only minimally from busked burins), and Aurignacian IV by biconical bone points. The Aurignacian V diagnostics are contested, as is the existence of the subunit itself, with some workers defining it by the occurrence of conical, bevelled-based bone points, and others (*e.g.* de Sonneville-Bordes 1982) arguing on chronostratigraphic and typological criteria that the Aurignacian V is a chimera, and that Aurignacian V assemblages have been systematically misclassified.

In addition to these allegedly time-sensitive stylistic marker types, there are also a small number of subjectively-defined non-artifactual criteria that, in a broader sense, are taken by some to mark the appearance of cognitively and behaviorally modern humans – a system of generalized, flexible behaviors fully consistent with those observed among foragers ethnographically (Table 17.2).

Although we have taken issue with the ability of typological systematics to make meaningful distinctions amongst Upper Paleolithic retouched stone tool assemblages (*e.g.* Clark *et al.* 1986), and have questioned the logic of inference that underlies the meaning assigned to pattern defined on the basis of typological criteria (*e.g.* Clark and Lindly 1991; Riel-Salvatore and Clark 2001; Clark 2002a), our purpose here is simply to assess whether or not the Aurignacian, as conventionally defined by west Eurasian workers, exhibits any compositional integrity whatsoever. Leaving aside the question of meaning, we and other workers (*e.g.* Straus 1996; Miracle 1998; Teyssandier *et al.* 2006) have become skeptical of the assumption that the Aurignacian is a single 'thing', that it is technologically and typologically consistent across space and time. If it can be shown that it has no compositional integrity, its utility as an analytical unit is open to question.

Table 17.1. Aurignacian Typological Diagnostics.

Aurignacian Typological Diagnostics

- carinated, keeled and 'nosed' endscrapers
- ordinary endscrapers made on blades (usually) or flakes (less commonly)
- big blades with invasive, scalar retouch (Aurignacian, strangled blades)
- *busqué* and/or Vachons type burins
- Dufour bladelets, Font-Yves/Krems-type retouched bladelets
- split-based bone 'points'
- lozenge-shaped, biconical points in ivory, antler and bone

Table 17.2. Non-Lithic Indicators of 'Aurignacianness.'

Non-Lithic Indicators of 'Aurignacianness'

- personal ornaments (beads made on organic blanks)
- tally-marked bone and antler objects; portable art in general
- earliest examples of parietal art
- 'well-organized' campsites, with pits, constructed hearths and other features

The Typological Composition of the Aurignacian

There are *c.* 185 reliably dated Aurignacian, Aurignacian-like, Proto-Aurignacian, and 'Aurignacoid' (*e.g.* Bachokirian) assemblages known from western Eurasia, roughly a 36% sample of the 507 radiocarbon dates available for the western Eurasian Aurignacoid industries through the late 1990s (Davies 2001, 202). We were unable to come up with a figure for the total number of Aurignacian and Aurignacian-like (*e.g.* Ahmarian) sites and levels reported from the region, but were able to examine a subset of assemblages that correspond to 52 levels in the 16 sites listed in Table 17.3. These were sites reported in sufficient detail to allow us to record basic statistical data on the numbers and kinds of retouched tools recovered. We make no a priori judgments about the comparability of artifact type definitions employed by different workers.

Retouched tool totals on these 52 assemblages amounted to 15720 pieces, with an average retouched tool component of 302 pieces per assemblage. The range varied from a low of one retouched piece (Siuren I, Fc) to a high of 1515 (Mochi, G). The incidence of retouched pieces relative to the total size of the collection is extremely variable in the 46 levels reported in sufficient detail for the statistic to be computed.[1] It varies from lows of 3.3% (Chainça), 3.5% (Morín, 7) and 3.8% (Trou Magrite, 2) to highs of 82% (Castillo, 18) and 54.6–69.5% (eight Pataud levels). The mean relative frequency is 25.5%.

Figure 17.1 displays notched box plots for endscraper, burin and Dufour bladelet relative frequencies, the only retouched types reported in sufficient quantities for statistical analysis. The notch corresponds to the median percentage of the corresponding class total (*i.e.* half of the levels are above, half below the notch). Figure 17.2 gives absolute frequencies (left margin) and relative frequencies (right margin) expressed as histograms for these common artifact types. Inspection of the figures underscores the extreme variability in these Aurignacian collections, even in regard to its supposed diagnostics. Particularly striking are the low values indicated by the notch points in Figure 17.1 (23%, 7%, 4% respectively). Many of the values in the 10th percentile in Figure 17.2 are actually zeros for all three tool classes, and this is particularly true of the allegedly distinctive Dufour bladelets (see *e.g.* Zilhão and d'Errico 1999), lacking altogether at Chainça and Castillo, in Trou Magrite 3, Geißenklösterle AH III, Pataud 11, 13, 8–11 ent., and at all but one (7–6a) of the Bacho Kiro levels.

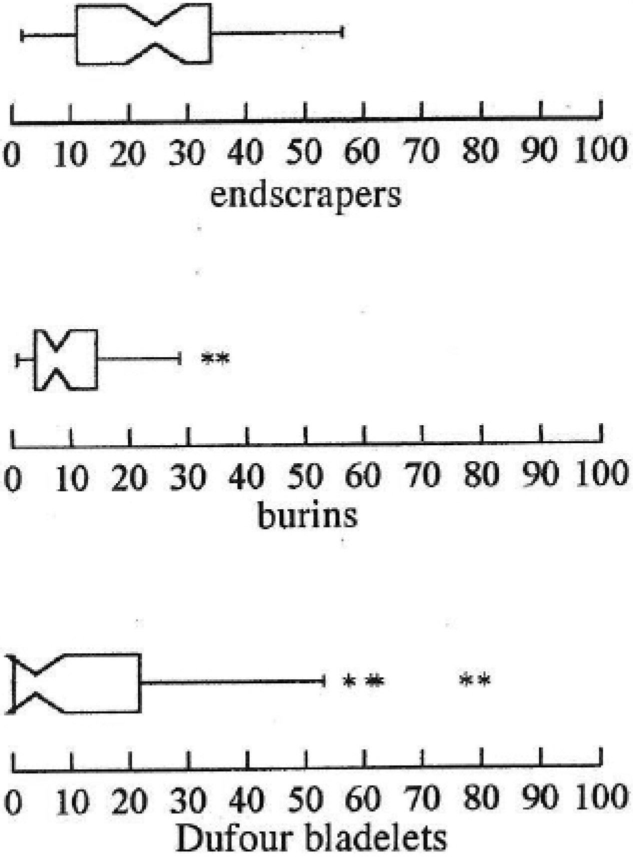


Figure 17.1. Box plots of the relative frequencies of endscrapers, burins and Dufour bladelets (n = 51, Siuren I, lev. Fc had only a single retouched piece, a Dufour bladelet). 95% confidence intervals around the median.

Table 17.3 Sites Analyzed, with Geopolitical Provenience, Number of Levels Examined, and Main Bibliographic References.

Site	*Country*	*Number of Levels*	*Bibliographic References*
Kebara	Israel	1	Ziffer 1978
Hayonim	Israel	3	Belfer-Cohen and Bar-Yosef 1981
Mochi	Italy	1	Kuhn and Stiner 1998
Siuren I	Georgia	9	Demidenko *et al.* 1998; Demidenko and Otte 2000/1
Bacho Kiro	Bulgaria	6	Kozlowski *et al.* 1982
Chainça	Portugal	1	Thacker 2001
Trou Magrite	Belgium	2	Straus and Otte 1995
Abri Pataud	France	8	Bricker *et al.* 1995; Brooks 1995
Warwasi	Iran	2	Olszewski 2001
Geißenklosterle	Germany	2	Hahn 1988
Fumane	Italy	5	Bartolomei *et al.* 1992
Castelcivita	Italy	2	Gambassini 1997
La Laouza	France	1	Bazile 1981
La Ferrassie	France	2	Delporte 1984; Blades 2001
Cueva Morín	Spain	5	González-Echegaray 1971
El Castillo	Spain	2	Cabrera Valdés 1984

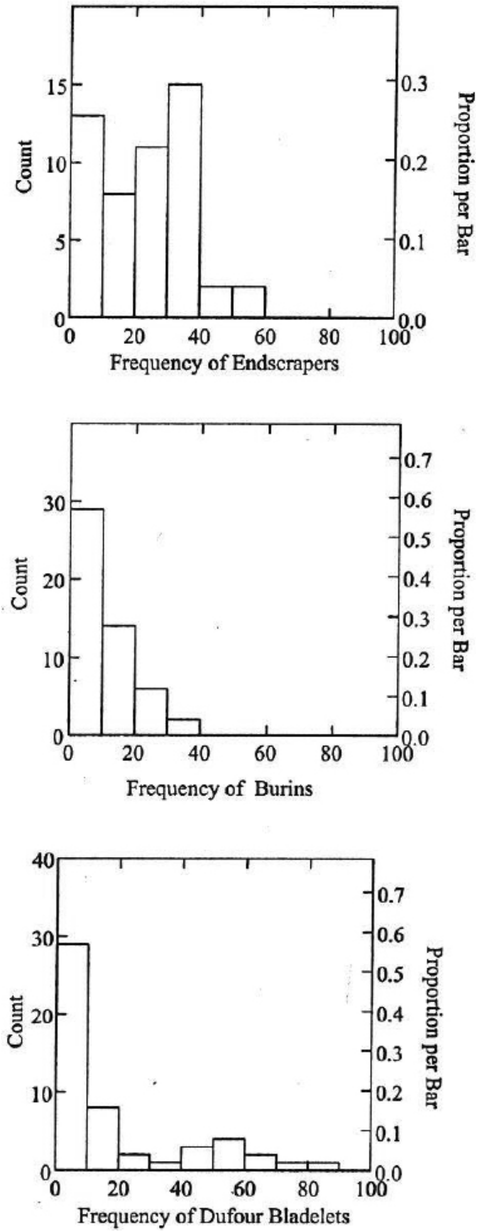


Figure 17.2 Absolute and relative frequency distributions for endscrapers, burins and Dufour bladelets ($n = 51$).

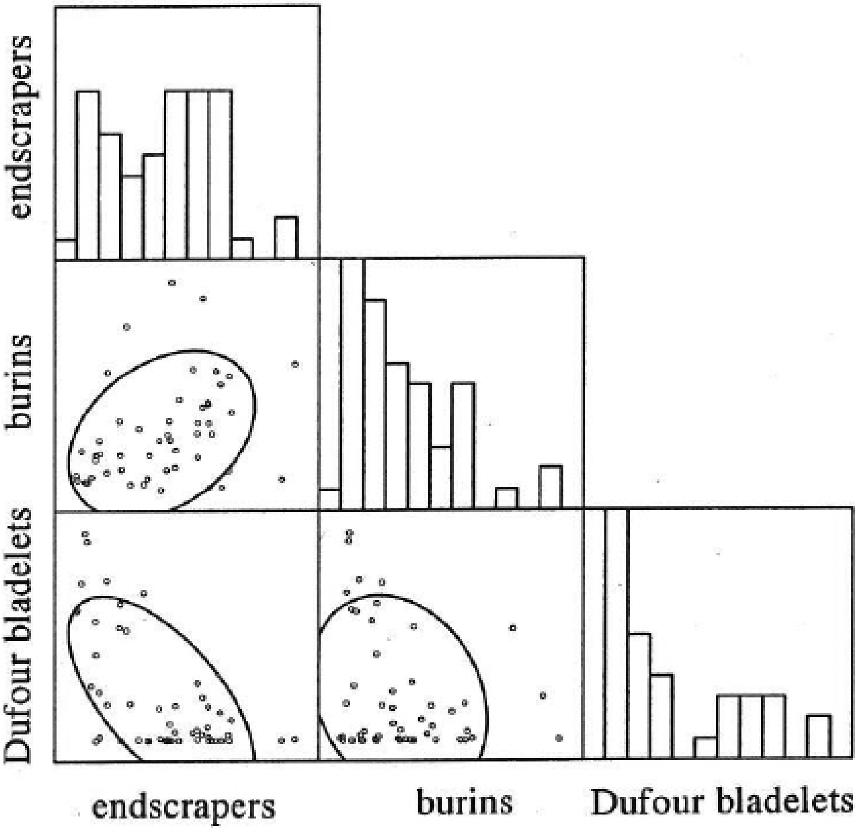


Figure 17.3 Correlation scatterplot matrices of endscrapers, burins and Dufour bladelets (n = 51).

Figure 17.3 and Table 17.4 indicate the extent to which these major retouched tool classes are correlated with one another. A moderately strong negative relationship between Dufour bladelets and endscrapers (*r* = -0.640) could indicate the existence of at least two types of Aurignacian assemblage, as defined typologically. This relationship is illustrated in Figure 17.4, a scatterplot that shows how endscrapers (the independent variable) constrain the distributions of the other tool types (treated here as dependent variables). Notice the inverse relationship between assemblages poor in endscrapers and burins, and rich in Dufour bladelets, and those rich in endscrapers and burins, and poor in Dufour bladelets. High Aurignacian indices (the Xs) are also correlated only with the latter group.

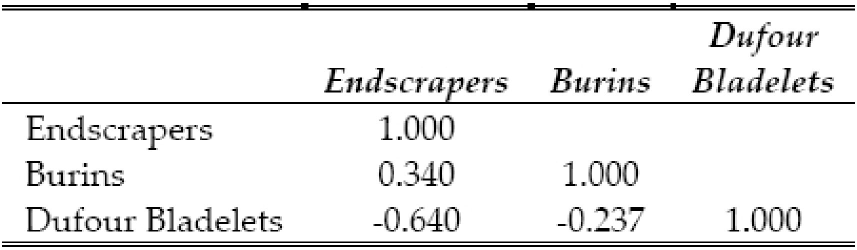
Table 17.5 displays the basic relative frequency statistics for the retouched tools; Table 17.6 summarizes the incidence of assemblages that fall outside the mean ± one standard deviation. Altogether 29% (44/153) of the assemblages lie outside that range for at least one of the three typological classes used to define the Aurignacian (more broadly, the EUP). However, different levels fall outside the range for different typological classes, and when individual levels that do so are summed, they account for no less than 61% (31/51) of the 51 levels in our sample.

If the same method is applied to the 40 collections for which a standard Aurignacian Index[2] could be computed, three additional cases fall outside that range of variability, bringing the figure up to 67% (34/51) of the sample. In other words, fully two-thirds of the assemblages sampled do not conform to expected patterns of covariation within the distribution of Aurignacian typological categories. Virtually every possible combination of endscrapers, burins and Dufour bladelets occurs, and the collections as a whole exhibit no modal tendencies whatsoever. Levels that contain significant numbers of endscrapers can have no, few or many burins; no, few or many Dufour bladelets, and so forth.

The Technological Composition of the Aurignacian

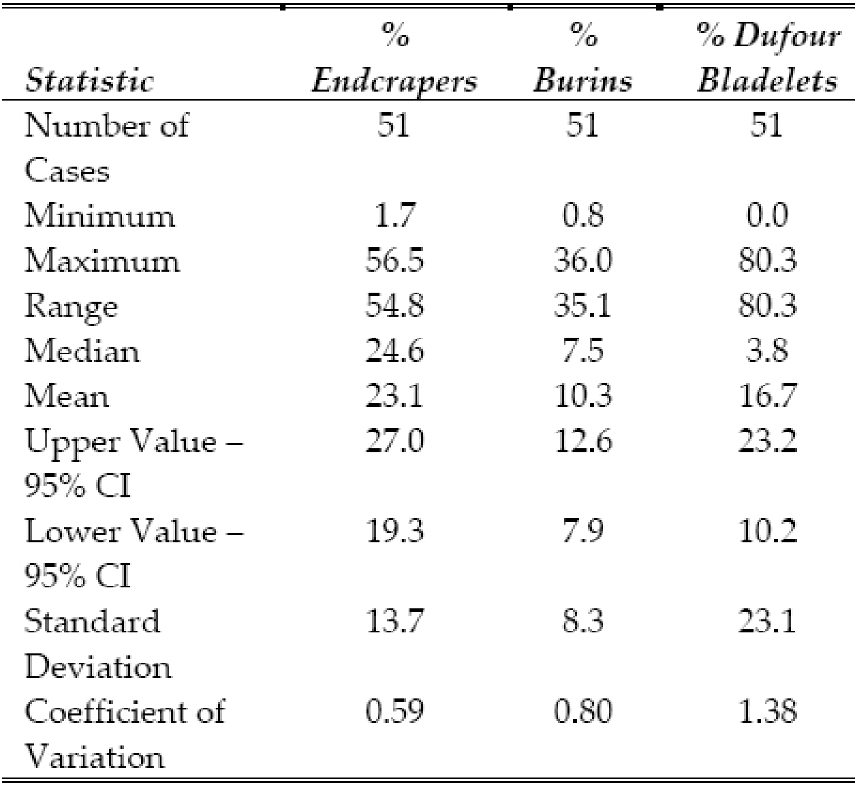
Efforts to examine the basic technological properties of the Aurignacian were hampered by an emphasis on typology (many do not report blank, core or debitage frequencies), and inconsistencies in blank (esp. blade, bladelet) definitions.[3] An inability to extract meaningful quantitative information on blank and core frequencies effectively reduced the sample size by half (to 26), although more information is available for some of the blank categories. Table 17.7 summarizes basic technological properties of the blanks chosen for retouch; Table 17.8 provides quantitative data on blade, bladelet and flake débitage frequencies, regardless of retouch. Again, the technological properties of the Aurignacian are shown to be extraordinarily variable. While all Aurignacian assemblages contain at least some blade blanks, they range in frequency from 3.2% at Laouza (2b1) to 34.3% (Castelcivita, II) and 29.5% (Castillo, 18). The mean frequency of blade blanks in the 26 collections for which blank statistics could be compiled is 15.3%. Tools made on blade blanks range from 8.7% (Castillo, 16) to 73.3% (Bacho Kiro, 7–6b); the mean is 35.5%. Bacho Kiro is noteworthy for an exceptionally high incidence of retouched blades (40–73%), but is poor in bladelets. Unretouched bladelets (most often defined as blades $<$ 3 cm long) range from a minimum of 0% (in 4 of 5 Bacho Kiro levels) to a maximum of 61.9% (Warwasi, P-Z); retouched bladelets from 0–65.1% (Siuren-I, Gb1–Gb2). The corresponding means are 22.2% and 24% respectively. Retouched bladelets are quite common in most of the Siuren-I levels, at Mochi (G), at Fumane, Castelcivita, Laouza, and El Castillo (18); they are rare or absent in Bacho Kiro and at most of the other sites. Although the Middle-Upper Paleolithic transition has been defined conventionally by a shift from flake to lamellar blanks, the incidence of flake blanks ranges from a minimum of 25.6% (Warwasi, P-Z) to a maximum of 92% at Castillo (16), and Morin (6, 7). Flakes larger than 3 cm are common in practically all Aurignacian collections, and the mean incidence of flake blanks is a robust 62.3%. Tools made on flake blanks range from a low of 13% (Castelcivita, I) to a high of 90% (Castillo 16, Trou Magrite 3). The mean is 40.1% (vs 35.5% for blades, 24% for bladelets), suggesting that the shift to lamellar blanks is more apparent than real, and that there is little evidence to support preferential selection for lamellar blanks to retouch in either the Aurignacian or the EUP (Figure 17.5). This conclusion is also consistent with the scatterplot shown in Figure 17.6, which plots the distributions of retouched bladelets and flakes (dependent variables) against that of retouched blades (the independent variable, expressed as a linear function). No pattern is apparent.

Table 17.4 Pearson Correlation Coefficient Matrix for Figure 17.3



	Endscrapers	*Burins*	*Dufour Bladelets*
Endscrapers	1.000		
Burins	0.340	1.000	
Dufour Bladelets	-0.640	-0.237	1.000

Table 17.5 Basic Statistics for Endscrapers, Burins and Dufour Bladelets.



Statistic	*% Endcrapers*	*% Burins*	*% Dufour Bladelets*
Number of Cases	51	51	51
Minimum	1.7	0.8	0.0
Maximum	56.5	36.0	80.3
Range	54.8	35.1	80.3
Median	24.6	7.5	3.8
Mean	23.1	10.3	16.7
Upper Value – 95% CI	27.0	12.6	23.2
Lower Value – 95% CI	19.3	7.9	10.2
Standard Deviation	13.7	8.3	23.1
Coefficient of Variation	0.59	0.80	1.38

Table 17.6 Incidence of Assemblages Above and Below One Standard Deviation of the Mean (Endscrapers, Burins and Dufour Bladelets).

Artifact Type	below -1σ	-1σ to $+1\sigma$	above $+1\sigma$
Endscrapers	12 (23.5%)	32 (62.7%)	7 (13.7%)
Burins	5 (9.8%)	37 (72.5%)	9 (17.6%)
Dufour Bladelets	0	40 (78.4%)	11 (21.6%)

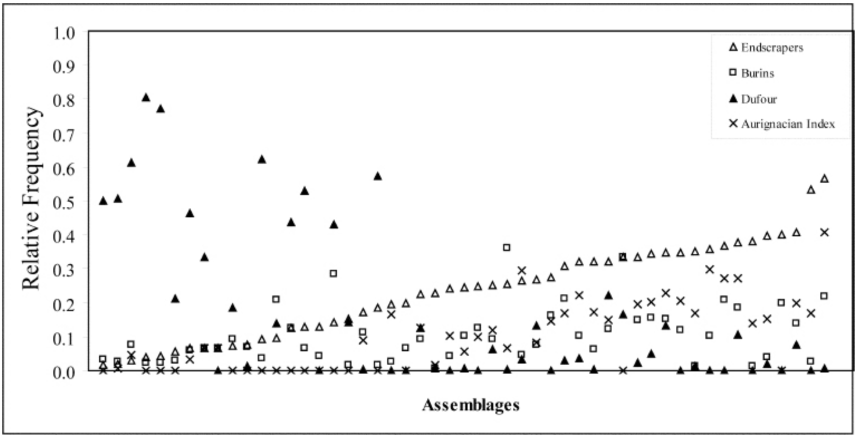
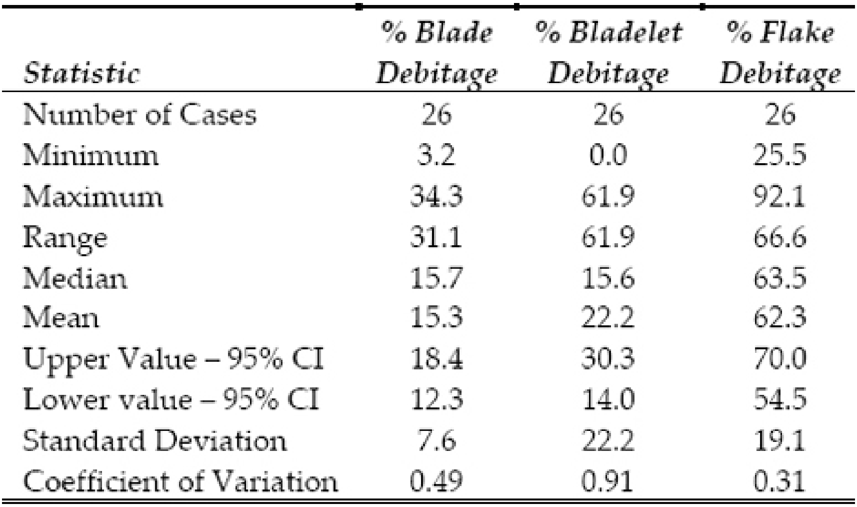


Figure 17.4 Scatterplot of burins, Dufour bladelets and Aurignacian Indices against endscrapers (n = 51).

Table 17.7. Basic Statistics Incidence of Blanks Chosen for Retouch.

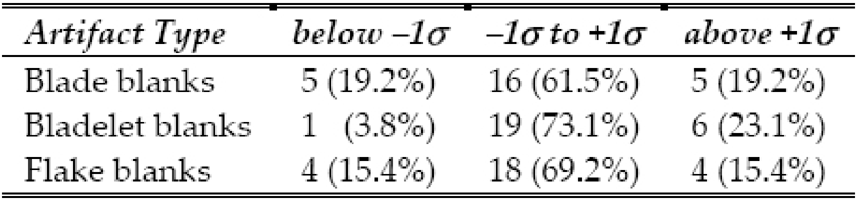
Statistic	% Blade Tools	% Bladelet Tools	% Flake Tools
Number of Cases	26	26	26
Minimum	8.7	0.0	13.0
Maximum	73.3	65.1	90.0
Range	64.6	65.1	77.0
Median	36.1	15.2	31.4
Mean	35.5	24.0	40.1
Upper Value – 95% CI	42.4	33.1	50.0
Lower value – 95% CI	28.7	14.9	30.3
Standard Deviation	16.9	22.5	24.4
Coefficient of Variation	0.47	0.94	0.61

Table 17.8. Basic Statistics Incidence of Unretouched Blades, Bladelets and Flakes.



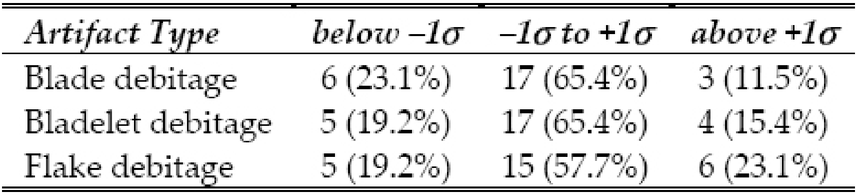
Statistic	% Blade Debitage	% Bladelet Debitage	% Flake Debitage
Number of Cases	26	26	26
Minimum	3.2	0.0	25.5
Maximum	34.3	61.9	92.1
Range	31.1	61.9	66.6
Median	15.7	15.6	63.5
Mean	15.3	22.2	62.3
Upper Value – 95% CI	18.4	30.3	70.0
Lower value – 95% CI	12.3	14.0	54.5
Standard Deviation	7.6	22.2	19.1
Coefficient of Variation	0.49	0.91	0.31

Table 17.9. Incidence of Assemblages Above and Below One Standard Deviation of the Mean (Retouched Blades, Bladelets and Flakes).



Artifact Type	below -1σ	-1σ to $+1\sigma$	above $+1\sigma$
Blade blanks	5 (19.2%)	16 (61.5%)	5 (19.2%)
Bladelet blanks	1 (3.8%)	19 (73.1%)	6 (23.1%)
Flake blanks	4 (15.4%)	18 (69.2%)	4 (15.4%)

Table 17.10. Incidence of Assemblages Above and Below One Standard Deviation of the Mean (Unretouched Blades, Bladelets and Flakes).



Artifact Type	below -1σ	-1σ to $+1\sigma$	above $+1\sigma$
Blade debitage	6 (23.1%)	17 (65.4%)	3 (11.5%)
Bladelet debitage	5 (19.2%)	17 (65.4%)	4 (15.4%)
Flake debitage	5 (19.2%)	15 (57.7%)	6 (23.1%)

The technological aspects of retouched and unretouched blanks are summarized in Tables 17.9 and 17.10 respectively. Based on the technological characteristics of blanks selected for retouch, 32% (25/78) of the assemblages lie outside the 67% confidence interval, suggesting a normal distribution (Table 17.9). But, again, when individual levels that do so are summed across individual blank types, they account for 69% (18/26) of the sample. The characteristics of unretouched blanks *(débitage)* are also interesting in this regard, with 16 of 26 collections (61.5%) showing greater than expected variation in their distributions (Table 17.10). As was the case with tools, some of the assemblages are exceptionally variable, with 13 cases in which two technological categories fall outside their respective ranges, and three cases where all three technological categories fall outside their ranges (Siuren-I, Fb1–Fb2; La Laouza, 2b1; El Castillo, 16). The plot of unretouched blade blanks against those of unretouched bladelets and flakes shows no clear pattern (Figure 17.7). In sum, it seems pretty clear that flakes were the dominant blank type produced *and* selected for subsequent retouch, a conclusion that departs from the received view that the Aurignacian is a blade-dominated 'technocomplex'. Blades only become more prevalent than flakes if they are combined with bladelets, and even then, only for tool blanks.

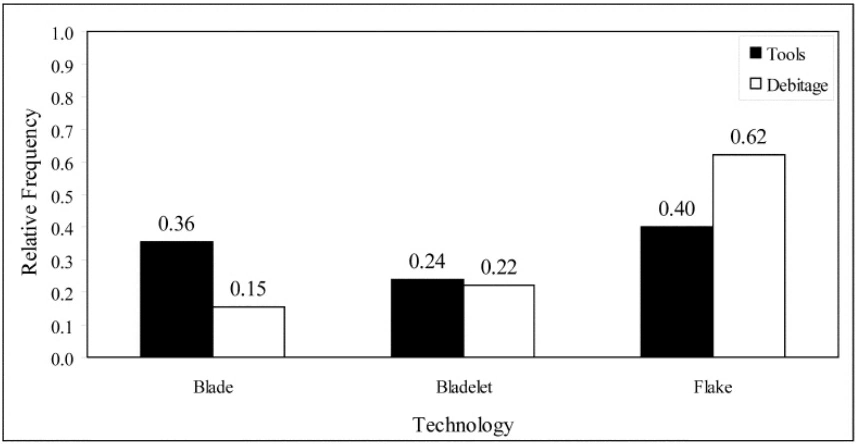


Figure 17.5 Mean frequencies for retouched and unretouched blades, bladelets and flakes (n = 26).

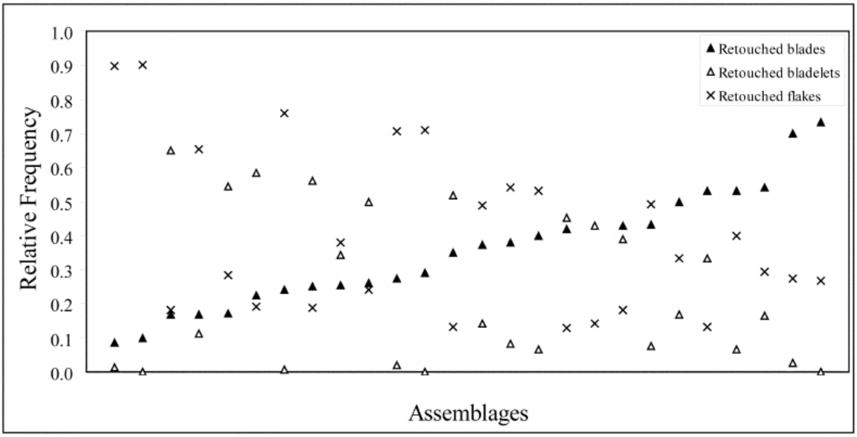


Figure 17.6 Scatterplot of retouched flakes and bladelets against retouched blades (n = 26).

Evidence for Organic Technologies

It proved difficult to get adequate quantitative information on evidence for complex (by inference, 'symbolic') behavior, here reduced to 'ornaments' (beads, mostly) and 'mobiliary art'. Slightly more than half (51.9%) the sites in the sample yielded ornaments, and roughly one-quarter (26.9%) contained mobiliary art of some kind (usually fragments of notched or incised bone) (Figure 17.8). As shown in Figure 17.9, however, ornaments tend to be very few. Twenty-seven collections yielded at least a single example, but of that number, 25.9% contained only one shell, bone or tooth bead; 66.7% between 1–10 such objects. Only four collections (*c*. 15% of the collections with ornaments, 7.7% of the total Aurignacian sample) yielded more than 20 ornaments. These four assemblages are Mochi (G), and three layers from Fumane,[4] both of which are temporally and geographically proximate, suggesting the kind of regional demographic clustering that might have selected for assertive style, rather than an identity expressed symbolically and shared across the western Eurasian landmass (see *e.g.* Barton *et al.* 1994; Clark *et al.* 1996). Regardless of the plausibility of this interpretation, these data stand in sharp contrast to White's view of a 'symbolic explosion' coincident with the appearance of the Aurignacian, and tend to undermine the notion that their production was a significant time and energy 'drain' on the part of Aurignacian foragers (*e.g.* 1989, 1993).

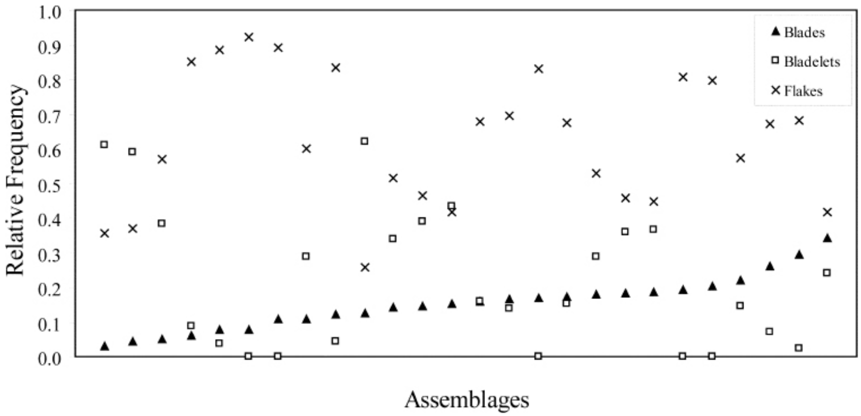


Figure 17.7 Scatterplot of unretouched flakes and bladelets against unretouched blades (n = 26).

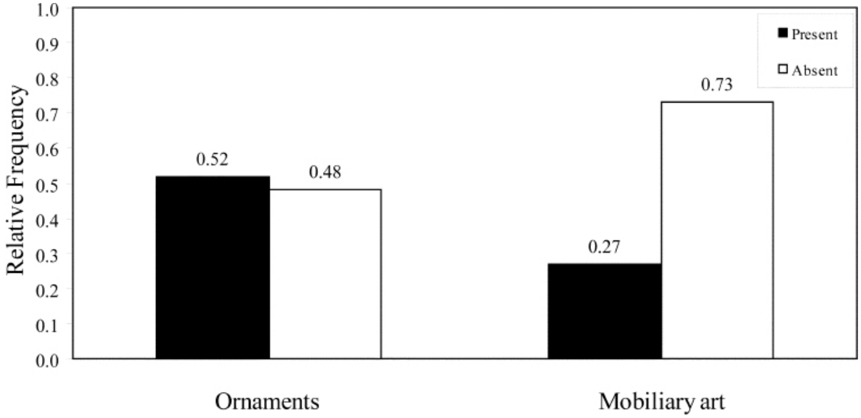


Figure 17.8 Presence and absence of ornaments and mobiliary art (n = 52).

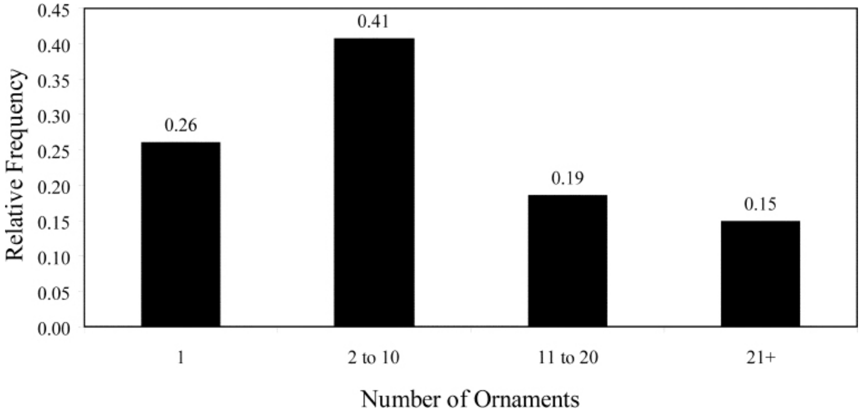


Figure 17.9 Absolute and relative frequency distributions of ornaments in sites that have ornaments (n = 27).

Pattern in the mobiliary art is also interesting. Although it undeniably occurs, it is extremely rare throughout the 18 millennia (*c.* 45–27k uncal BP) assigned to the Aurignacian by Davies (2001, 195). In our sample, only two Hayonim layers, two levels at Geißenklösterle, and Trou Magrite (3) produced anything that could be called ‘complex’ or ‘elaborate’ examples. Mobiliary art is a ‘catch-all’ category that includes the elaborate Geißenklösterle statuettes, but also (and predominantly) non-descript incised bone fragments like those sometimes found in Mousterian sites. In fact, only the five collections just noted (9.6% of the total sample) contain ‘fancy’ mobiliary art, again reinforcing the idea that complex examples are extremely rare (esp. when their occurrence is scaled to unit time).

Conclusions

What is the Aurignacian? Many workers who have faith in the credibility of the Aurignacian as an analytical unit see it as a reflection of behavior related in some way to a modern human dispersal from a presumed source in Africa (*e.g.* Mellars 1996; Davies 1999, 2001). Corollary heuristic assumptions of this view include (1) rejection of the 'short chronology' proposed for it by Zilhão and d'Errico (1999), (2) rejection of the idea that it represents an identity-conscious ethnic and/or linguistic group (a 'culture', in the conventional sense of the term), (3) acceptance of the view that it is technologically and typologically consistent across space and time, and (4) that it represents a complex system of flexible and generalized behaviors that marks the appearance of behavioral 'modernity' (*e.g.*, Davies 2001, 195–196). This package of assertions cannot be broken apart; in a paradigmatic sense, it forms a unified whole. As we have shown, however, there is little empirical support for the technological and typological consistency invoked to sustain it.

Our pattern search uncovered many other aspects of Aurignacian material culture that call 'conventional wisdom' into question (*e.g.* the notion of 'imposed form' and its cognitive implications; see also Hiscock and Attenbrow 2003). We intend to develop these lines of inquiry further but, because these analyses remain incomplete, we cannot do it here. Taken together, however, these empirical findings constitute strong support for our initial contention that the Aurignacian is not a single 'thing', but rather a chimera created by an illusion of technological, typological and chronological consistency that has no basis in fact. When a broader perspective is adopted that emphasizes the material correlates of human adaptation, what emerges from the west Eurasian archaeological record over the 54–27 kyr bp interval is a complex mosaic of different lithic technologies and tool types; patterns in raw material procurement, reduction and discard; blank types, metrics and frequencies, bone and antler technologies, evidence for symbolic behavior, subsistence strategies and settlement patterns that recalls the complex patterns evident in the late Mousterian (Howell 1999, 219–226). While these different aspects of adaptation doubtless comprised 'a complex system of flexible and generalized behaviors,' there appears to be little to distinguish a uniquely Aurignacian adaptation from the material record of the late Mousterian that preceded it (see Clark and Riel-Salvatore (2006) for a discussion of variability in the Mousterian and its implications for behavioral modernity).

A 'Grumbling Resistance'

At the annual meeting of the Society for American Archaeology in 2002, we asserted that the basic analytical units used in Upper Paleolithic archaeological research are (1) 'accidents of history', created – for the most part – by French prehistorians between *c.* 1880 and *c.* 1940 in order to solve chronological problems, (2) that they are based on typological systematics and have become essentialized by subsequent workers, (3) that they have little or no compositional integrity across space and time, (4) are defined differently by different workers, and (5) that there is no consensus about what they mean or represent behaviorally (Clark and Riel-Salvatore 2002). While we take these assertions to be unexceptional and, in fact, incontestable, they nevertheless provoked 'a grumbling resistance' (Marean and Thompson 2004) on the part of some in the audience to which we respond briefly below.

We submit that these observations were uncontroversial, and were entirely consistent with a broadly scientific, critically self-conscious approach to our discipline. No one could deny that, if paleolithic archaeology had arisen somewhere other than where it did (*e.g.* Africa, instead of Europe), the analytical units would have taken on a very different character (see, *e.g.*, the extended criticism of Eurocentric bias by McBrearty and Brooks [2000]). It is our opinion that negative reactions to remarks like those cited above are sometimes construed as (unwarranted) criticisms of European conceptual frameworks and, by implication, the research traditions that produced them – especially those of the 'founders' of paleolithic archaeology, the French.

We wish to make clear that we are not criticizing the French, Latin Europeans, Central Europeans, or indeed anybody (except, perhaps, strict empiricists – people who think 'the facts speak for themselves'). The French were only doing what all scientists do – creating analytical units they thought relevant and appropriate to some problem they were trying to solve (Sackett 1968, 1991). We archaeologists don't have natural analytical units like the biologists do. We have to create them, and the only way we can do that is in terms of some problem of interest. But problems are embedded in problem contexts, problem contexts in research traditions, and research traditions in broader intellectual *milieux* (sometimes called metaphysical paradigms (Masterman 1970)) that differ from one another in respect of implicit biases, preconceptions and assumptions about their subject matter (in this case, what the past was 'like') (Binford and Sabloff 1982; Clark 1993).

Because many problems and questions regarded as 'significant' (*e.g.* our biological and cultural origins) are held in common by relatively distinct national and regional research traditions, it is illuminating to try to catch a glimpse of the metaphysics that underlie their 'worldviews'. This is an extremely complex endeavor perhaps best attempted by historians and philosophers of science (see *e.g.* papers in Corbey and Roebroeks (2001)). It has been argued, for example, that prehistoric archaeology in the Old and New Worlds proceeds from fundamentally different views of the past, founded on fundamentally different metaphysical paradigms (Binford and Sabloff 1982). Underlying many European approaches is the preconception that prehistory is history projected back into the preliterate past, and that process in the remote past can be treated as analogous to, and an extension of, process in history. This contrasts sharply with the ecosystems biases that underlie American approaches (Clark 1993, 2002b). The latter have in turn been accused of turning away from their anthropological roots and adopting what many Europeans see as a rather crude form of ecological reductionism. There is also variation within research traditions, and geographically distinct approaches within nations (*e.g.* the contrast between the francophone-dominated perspective of many north Spanish prehistorians, and the anglophone-influenced ecological approach of those working in Spanish Levante (Camps 2006)). These differences are owed to individual differences in training and background, where individual researchers were educated, and subsequent career interests.

It's important to keep in mind that metaphysical paradigms are typically not subjected to much critical scrutiny *within* research traditions and have no objective reality beyond that conceded them by their adherents. So, from one point of view, one metaphysical paradigm is 'as good as another' (*i.e.* its internal logic is consistent, its explanations coherent given that logic). However, those who subscribe to different metaphysical paradigms can maintain an interminable discourse without ever resolving anything because they employ distinct fundamental concepts, and give to superficially shared concepts different meanings (see *e.g.* Willermet 1993, 1994, 2002; Willermet and Clark 1995). Because the assumptions underlying the metaphysical paradigm determine the character of its subordinate paradigms (which in turn determine research protocols in any problem context), conflicts often arise in respect of the nature of explanation, and what kinds of explanations are regarded, *a priori*, as plausible or not. From an American perspective, there are big problems with the contention that prehistory is an extension of history, and these have far-reaching implications for some European construals of pattern, and what it might mean.[5]

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Notes

1. The relative frequency of retouched pieces is the total number of retouched pieces divided by the sum of unretouched flakes and blades, waste, cores and retouched pieces.
2. The Aurignacian Index comprises Types 1–14, and 32 *(burin busqué)* in a standard de Sonneville-Bordes and Perrot (1953) type list. The remaining 11 assemblages were classified either by the Laplace system, or idiosyncratically, thus making it impossible to compute the index.
3. Blades are usually defined on the basis of length:width ratios > 2:1 as measured along, and perpendicular to, the axis of percussion, but some use the additional criterion of parallel dorsal ridges so, even if the dimensions of a piece as measured along the axis of percussion are > 2:1, it is not classified as a blade if it lacks parallel dorsal ridges (Bar-Yosef and Kuhn 2001).
4. These large collections also have lots of Dufour bladelets (*e.g.* 80.3% [562 examples] in Fumane, A3 + A2).
5. For a splendid, current example of paradigm conflict at the level of the metaphysic, contrast Bosselin and Djindjian (1999, 2000) with Straus and Clark (2000).

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18. La Confusion Aurignacienne: Disentangling the archaeology of modern human dispersals in Europe

Paul Mellars

Introduction

Few topics have generated more debate in the recent literature on modern human origins in Eurasia than the significance of the so-called "Aurignacian" technologies. Much of this debate, as I have discussed elsewhere (Mellars 2003, 2004, 2006), clearly derives from misundertsandings, disagreements or plain confusions over the notion and definition of the Aurignacian concept, and its applications to different segments of the early Upper Palaeolithic record in the different regions of Eurasia.

Underlying these confusions however there seems to be an emerging concensus that over at least the greater part of Europe there are two fairly well defined and clearly separated industries which have, for largely historical reasons, become fused together under the all-embracing "Aurignacian" term. The first of these is what is now generally referred to as the "classic" Aurignacian – which must presumably be defined in relation to the industry originally recovered from the type-site of Aurignac itself in the lower Pyrenees region of southwestern France (Lartet 1860; Breuil 1912, Sonneville-Bordes 1960; Bon 2002). In France itself, this is generally equated (at least in its earlier stages) with the industries which have been traditionally referred to as "Aurignacian I" or "Aurignacien Ancien", and defined by a range of distinctive tool forms (principally "carinated" and "nosed" scrapers and extensively edge-retouched "Aurignacian blades") combined with the classic "fossile directeur" of this grouping in the form of the highly distinctive "split-base" bone and antler points – significantly defined originally as "*pointes d'Aurignac*" (Figure 18.1) (Sonneville-Bordes 1960; Bon 2002). Defined in these terms there now seems to be an equally broad consensus that industries conforming closely to this "classic" Aurignacian form can be identified across a broad arc of western, central and eastern Europe, and extending into at least the northern part of the Near East in the form of what has generally come to be referred to as the "Levantine Aurignacian" (Figure 18.2) (Bordes 1968; Hahn 1977; Mellars 1992, 2001, 2004, 2006; Bar-Yosef 2000; Conard and Bolus 2003; Kozlowski 2004, 2005). It should be noted that although the original definition of the Near Eastern ("Levantine") Aurignacian was originally based strictly on the character of the lithic assemblages (Neuville 1934; Garrod 1953, 1957) the strength of this diagnosis has recently been strikingly underscored by the discoveries of entirely typical split-base bone points (Figure 18.3) from at least three of the Israeli sites – Hayonim, Kebara and El Quseir (Belfer-Cohen and Bar-Yosef 1999; Bar-Yosef 2000). In both western France and the Levant these "classic" Aurignacian industries are dated to around 32,000–36,000 BP (Mellars and Tixier 1989; Bar-Yosef *et al.* 1996; Bar-Yosef 2000; Mellars 2000; Bon 2002). As I have commented elsewhere: "At no other point in the Upper Palaeolithic sequence can one demonstrate such a remarkable uniformity in culture and technology extending over such a wide diversity of contrasting topographic and ecological zones" (Mellars 1992, 226–227).

The second equally well defined entity is represented by what has generally been referred to as the grouping of "Proto-Aurignacian" (or "Archaic" Aurignacian) industries, distributed principally along the the Mediterranean coastline of Europe (Figure 18.2) extending from at least northeastern Italy (as at the Grotta Fumane and El Paina) via the southern French coast and the Pyrenees to northwestern Spain (as at Cueva Morin) – with rare apparent outliers both in southwestern France (at Le Piage in the Lot region) and in southern Austria (at Krems Hundssteig and Senftenberg) (Hahn 1977; Djindjian 1993; Maillo-Fernandez *et al.* 2001; Bon 2002; Normand and Turq 2005). The dominating feature of these "Mediterranean Proto-Aurignacian" industries is the presence of large numbers of small to medium-sized bladelets, struck from specialized forms of single-platform bladelet cores, and shaped by means of relatively light "semi-abrupt" retouch – frequently on the ventral as opposed to the dorsal faces of the bladelets – into distinctive "lamelle Dufour" and more sharply pointed "Font-Yves point" forms (Figure 18.4). Significantly, these forms seem to be virtually if not completely lacking in the classic early Aurignacian industries of western France, while the bladelet-dominated industries similarly seem to to contain very few if any of the "classic" Aurignacian types, in the form of thick, nosed and carinated scrapers and heavily edge-retouched Aurignacian blades (Sonneville-Bordes 1960; Bon 2002). And where typical split-base bone or antler points have been found in the Mediterranean sites, these seem invariably to be stratified immediately above the main bladelet-dominated levels – as for example at Grotta Fumane, Riparo Mochi, Esquicho Grapaou, L'Arbreda, Isturitz and Le Piage (Bon 2002). In view of all these contrasts I have suggested that it would now be much better to separate out these so-called "Proto-Aurignacian" industries under a separate taxonomic label, for which I have suggested the term "Fumanian" – based on what is at present the best documented and most fully published occurrence of these industries at the Grotta Fumane in northeast Italy (Mellars 2003, 2006). This would have the supreme advantage of avoiding any *a priori* assumption of a direct ancestral or genetic relationship between the two groups of industries, which remains at best a highly debatable proposition, as discussed further below.

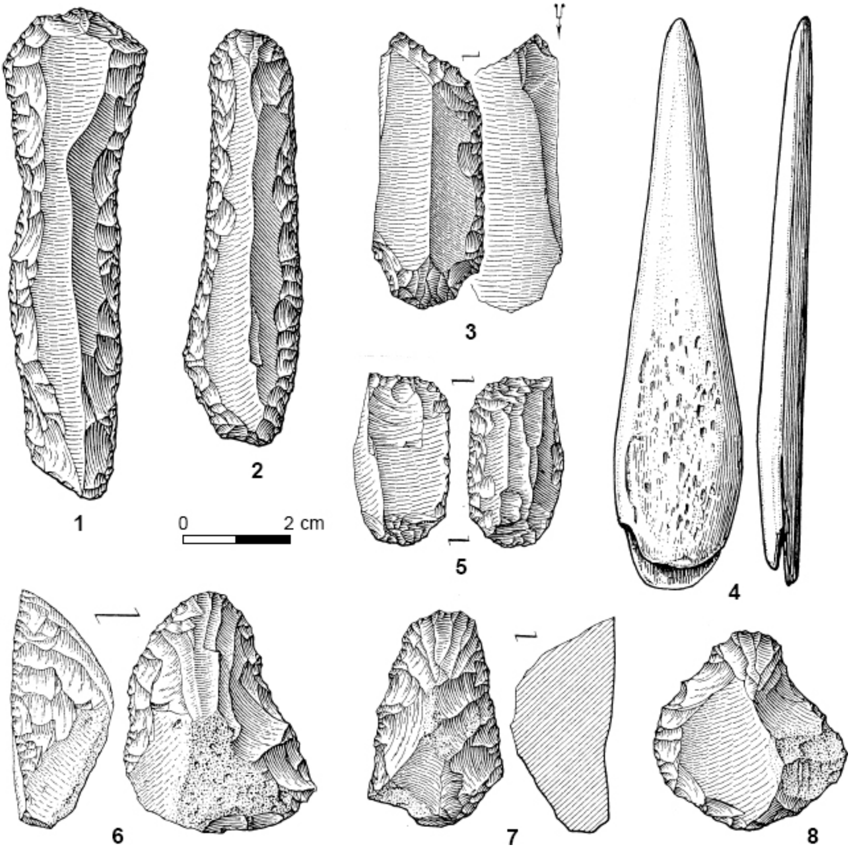

Figure 18.1. Characteristic tool types of the "classic" early Aurignacian industries ("Aurignacian I") in southwest France. Nos. 1, 2 edge-retouched Aurignacian blades; 3 combined truncation burin and end scraper; 4 split-base antler point ("pointe d'Aurignac"); 5 scaled piece; 6, 7 carinate scrapers; 8 nosed scraper. After Bordes 1968; Champagne and Espitalié 1981.

If these two basic components of the overall "Aurignacian" phenomenon are now fairly widely recognized, the question of the origins of these technolgies, and their associations with specific hominid types, are at present topics of lively debate (Kozlowski and Otte 2000; papers in Zilhão and d'Errico 2003a; Kozlowski 2004, 2005). The remainder of the present paper will focus specifically on these two questions, viewed in the light of the most recent archaeological discoveries in the different areas of Europe itself and the adjacent areas of the Near East (see also Mellars 2003, 2004, 2006).

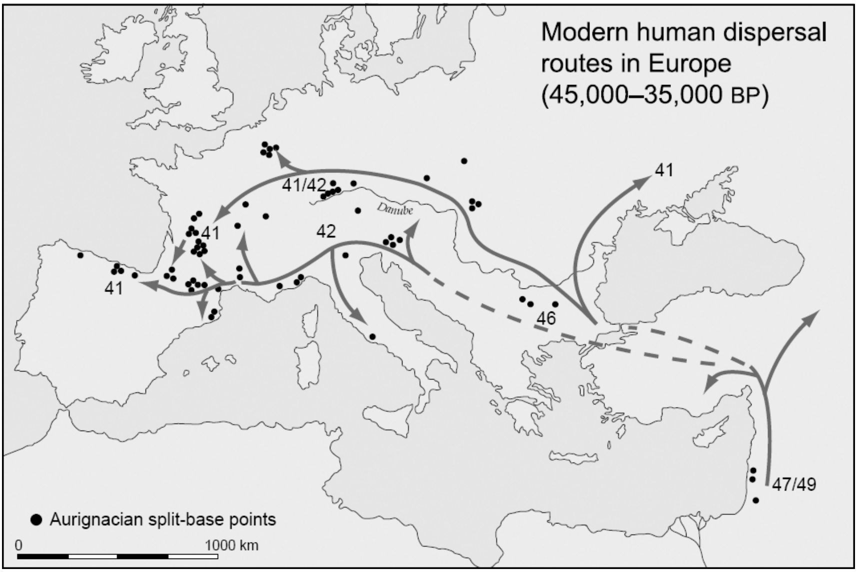
Modern human dispersal routes in Europe (45,000–35,000 BP)
41
41/42
Danube
41
42
41
46
47/49
● Aurignacian split-base points
0
1000 km

Figure 18.2. Map showing the inferred dispersal routes of anatomically modern populations across Europe, represented respectively by the "classic" Aurignacian industries, mainly along the Danube valley, and the Fumanian ("Proto-Aurignacian") bladelet industries along the Mediterranean coast. Patterns of dispersal across Turkey are at present uncertain due the lack of well documented sites. The figures indicate the earliest radiocarbon dates for the industries in different regions (expressed in terms of thousands of years BP), calibrated in terms of the recent calibration data from the Cariaco Basin and elsewhere. The distribution of split-base bone and antler points is also shown.

The origins of Aurignacian technology

If the Aurignacian represents in some way the archaeological reflection of the dispersal of anatomically modern populations over at least the central and western parts of Europe – as is now fairly widely agreed (*e.g.* Mellars 1992, 2001, 2004; Djindjian 1993; Kozlowski and Otte 2000; Davies 2001; Conard and Bolus 2003; Zilhão and d'Errico 2003b; Kozlowski 2005) – then the question of the cultural and demographic origins of this technology becomes one of the most significant issues in current studies of modern human origins in Europe. There has been a plethora of literature on this topic over the past fifty years which can hardly be said as yet to have arrived at anything approaching a concensus (Straus 2003; Tsanova and Bordes 2003; Zilhão and d'Errico 2003a, b; Kozlowski 2004, 2005). If we concentrate on what has been defined above as the "classic" form of the Aurignacian, however, two main models have been debated, which may in fact have more in common than has been generally recognized hitherto.

The most explicit model advanced so far for the origin of the "classic" Aurignacian technology is based on the sequence of early Upper Palaeolithic industries in southeastern Europe, derived primarily from the two sites of Bacho Kiro and Temnata located to the south of the Danube Valley in Bulgaria (Kozlowski and Otte 2000; Kozlowski 2004). In his original report on the Bacho Kiro excavations, Kozlowski defined a distinctive "Bacho Kirian" facies, based on the industry recovered from layer 11, stratified between the final Mousterian level (layer 12) and the sequence of overlying, typical Aurignacian industries in layers 6–9 (Kozlowski 1982). In his original report, Kozlowski emphasized three main features of the Bacho Kirian industry: Firstly, its clearly Upper Palaeolithic character – marked by the clear dominance of blade over flake technology, the presence of typical end scrapers, burins and edge-retouched blade forms, the apparent absence of distinctively Mousterian tool types and the presence of two typical perforated animal-tooth pendants. Secondly, the sharp contrast between this industry and the immediately underlying Mousterian industry – emphasized further by the use of almost entirely non-local flint resources in the Bacho Kirian (introduced from sources at least 100 km from the site) as opposed to purely local sources in the Mousterian level. To him this suggested that the Bacho Kirian was an entirely intrusive phenomenon, probably introduced by new populations deriving from further to the east. And third, the presence of several types which were strongly reminiscent of Aurignacian forms, such as a number of thick, steeply worked end scrapers and blades with invasive, Aurignacian-like retouch. These features, combined with the very early date of >43,000 BP secured on a large charcoal sample collected from a hearth at the base of the Bacho Kirian levels, led Kozlowski to suggest the the Bacho Kirian could well represent an industry directly ancestral to the immediately ensuing Aurignacian industries in the Balkan region (Kozlowski 1982, Kozlowski 1992; Kozlowski and Otte 2000). Although this has tempted a number of later workers to assimilate the Bacho Kirian industry directly into the broader, pan- European “Aurignacian” tradition, it should be recalled that Kozlowski himself was initially commendably cautious of this interpretation and – wisely – chose to allocate the industry provisionally to a taxonomically separate “Bacho Kirian” group.

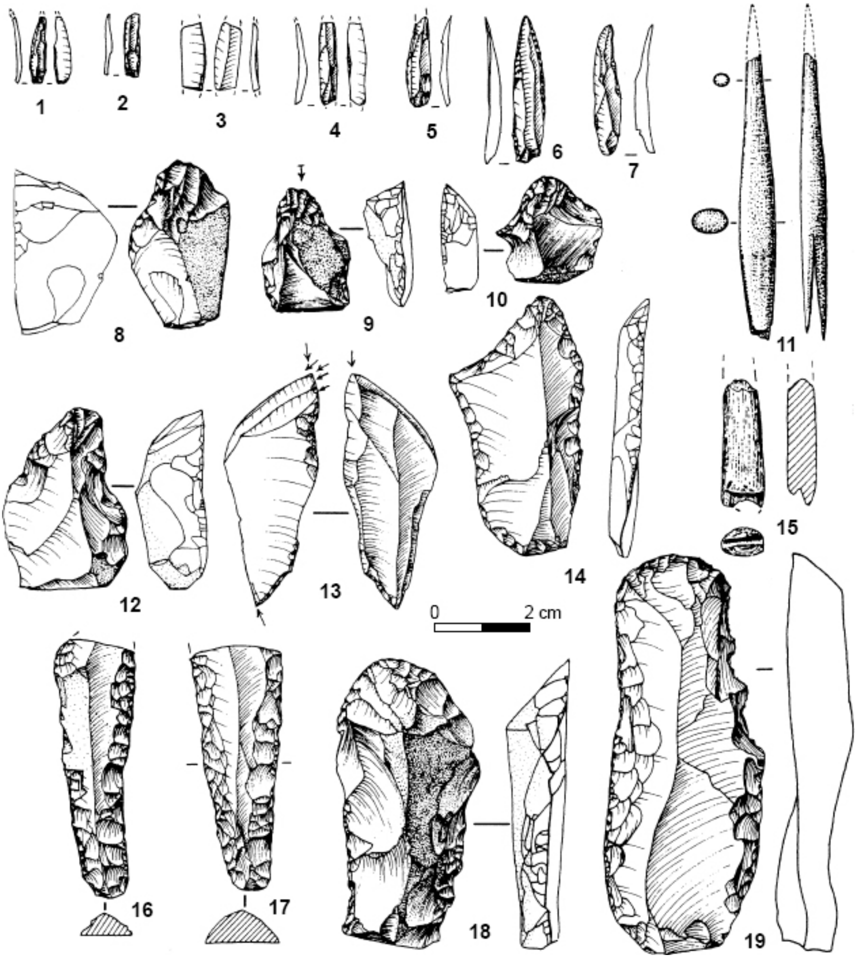

Figure 18.3. Typical "Levantine Aurignacian" industry from the Hayonim cave, Israel, showing a range of forms closely similar to those of the "classic" Aurignacian in western and central Europe. Nos. 11 and 15 are split-base bone points (no. 13 from the Kebara cave). After Bar-Yosef (2000).

The second model which has been debated for the origin of Aurignacian technology is centred further to the east within the Near Eastern region, based primarily on the long succession of early Upper Palaeolithic industries recovered from the 18–metres-deep succession at Ksar Akil in Lebanon, originally excavated by Ewing and Docherty immediately before and after the second World war (Ewing 1947). Following detailed analyses of this succession by Azoury (1986), Bergman (1981, 1987), Ohnuma and Bergman (1990), Copeland (1975, 1976) and others it has been generally agreed to divide this succession into three major stages (see Copeland 1975, 1976):

1. Levels 25 to 21 of Ewing's sequence were attributed to what was designated

formally as “Ksar Akil Phase A”, but which was recognized as showing specific similarities to the material from a number of sites in northern Israel which had generally been known as “Emiran” (Garrod 1953, 1957) and regarded as representing the initial phase of the overall Upper Palaeolithic sequence in the Near East.

2. Levels 20 to 14 of Ewing’s sequence were designated as “Ksar Akil Phase B”. These were seen as having many similaritries to the underlying Phase A industries, but as showing more highly developed blade techniques, together with a number of new forms such as relatively large, edge-retouched pointed blades (defined by Azoury as “Ksar Akil points”) and some specialized new burin forms (Azoury 1986; Copeland 1987). More recently, these levels have been attributed to a new technological grouping, referred to as “Ahmarian” – though apparently deriving from the underlying “Phase A” or “Emiran” levels (Belfer-Cohen and Bar-Yosef 1999; Bar-Yosef 2000; papers in Goring-Morris and Belfer-Cohen 2003).
3. Levels 13 to 6 of the Ksar Akil sequence were formally designated as “Levantine Aurignacian” (a newly introduced term) and included a succession of three major stages, which were defined respectively as “Levantine Aurignacian phases A, B and C” (Copeland 1976, 1987). Of these, the uppermost level (Levantine Aurignacian C) showed the most classic features of Aurignacian technology in the form of highly typical carinate and nosed scrapers and polyhedral, multi-factetted burins but – unlike the underlying levels – showed a clear predominance of tool manufacture on relatively broad flakes, as opposed to elongated, typical blade forms (Bergman 1987). The underlying levels of the Aurignacian A and B were characterized by much higher levels of blade technology and in most levels (especially layers 9–11) included large numbers of carefully retouched small bladelet forms (Figure 18.5), comprising what in European terms would be described as “lamelles Dufour” together with more sharply pointed forms which in European terminology would be described as “Font Yves” (or “Krems”) points, but which in the pre-existing Near Eastern literature had generally been referred to as “El Wad points”, following the excavations of Dorothy Garrod at El Wad on Mount Carmel (Bergman 1981, 1987). In all the earlier publications by Garrod and others these small retouched bladelet forms had invariably been found immediately below the more classic Aurignacian industries (as at El Wad and Kebara) and generally seen (as at Ksar Akil) as marking the initial episode of the overall Aurignacian sequence in the Near Eastern region (Ronen 1976).

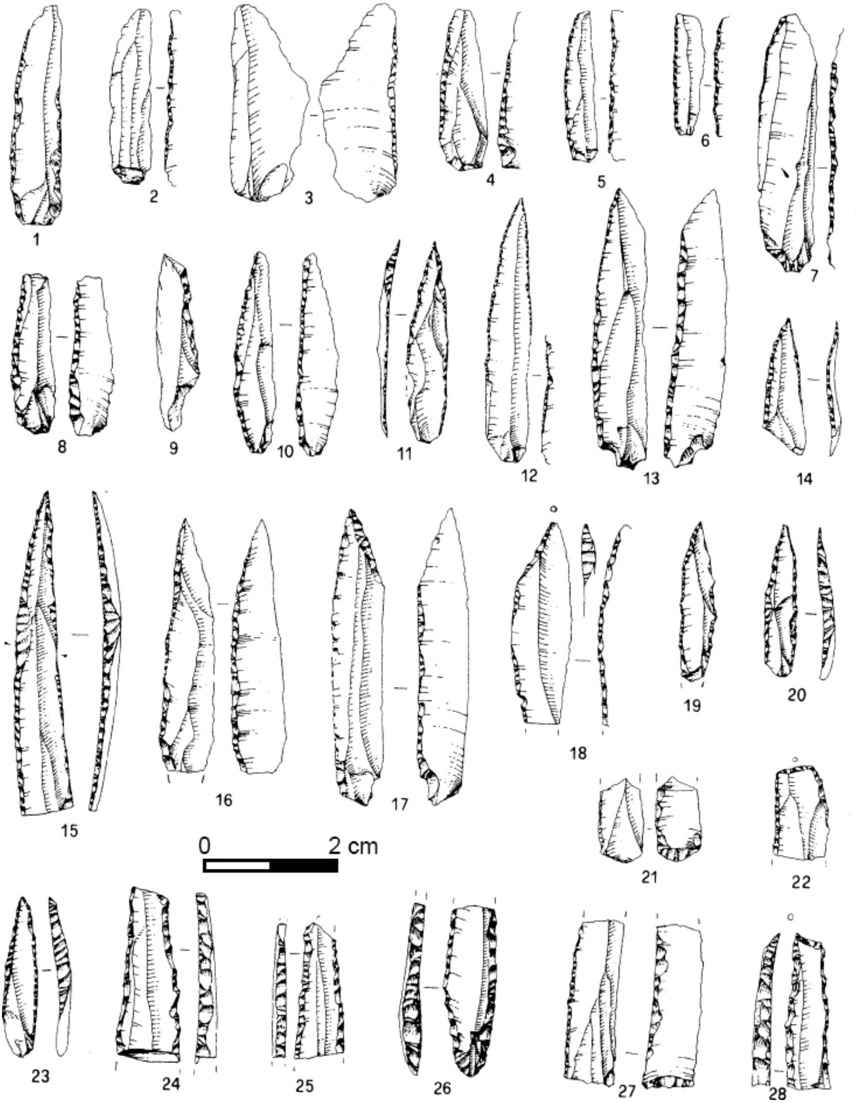

Figure 18.4. Finely retouched bladelets from the Fumanian ("Proto-Aurignacian") levels of the Fumane Cave, northeast Italy. Nos. 11, 12, 15, 19, 23 are Font-Yves points; nos. 1–7 are Dufour bladelets. The rest are broken or intermediate forms. Note the presence of either inverse or alternate retouch on the dorsal and ventral faces of many of the pieces.

As I have discussed in more detail elsewhere (Mellars 2005) more recent workers in this region have tended to apply a much more restricted definition of the "Levantine Aurignacian" notion, which would confine this entity entirely to the final ("Levantine Aurignacian C") episode of the Ksar Akil sequence – based essentially on the (slightly esoteric) premise that the Levantine Aurignacian should be defined as a strictly flake as opposed to blade-based technology (Copeland 1987; Bergman 2003). Viewed in these terms, they see the Levantine Aurignacian as a strictly intrusive phenomenon within the Near Eastern region, probably originating (as argued by Kozlowski) within the Balkan region, and perhaps driven back into the Levantine area by the onset of very cold conditions around 36,000 BP (Belfer-Cohen and Bar-Yosef 1999; Bar-Yosef 2000).

In this context however it should be noted that several other workers have argued for much greater technological continuities within the Ksar Akil sequence itself – as of course the original, three-phase definition of the "Levantine Aurignacian" formally agreed at the London conference on the terminology of the Near Eastern industries in 1969 had originally implied (Copeland 1975, 1976, 1987). In his detailed analysis of the Ksar Akil sequence, Bergman (1987) repeatedly emphasized the presence of typical nosed and carinated scraper forms in all of levels 13 to 6, and commented "another significant feature is the presence of several assemblages (levels XIII-IX) which are blade and bladelet based with varying percentages of Aurignacian tools. This facies is known at a few other sites in the Northern Levant and may suggest that the Levantine Aurignacian initially developed out of the local blade-based cultures" (Ohnuma and Bergman 1990, 136). The same point had been made earlier by Copeland (1975, 1976) and in 1988 Marks and Ferring echoed the same observation: "With respect to an early Ahmarian-Levantine Aurignacian developmental sequence, the best evidence again comes from Ksar Akil, where in levels 13 through 9 there is a marked trend towards increasing Aurignacian elements within a basically Ahmarian technology" (Marks and Ferring 1988, 68). The possibility of a gradual emergence of distinctively Aurignacian technology within the early Upper Palaeolithic sequence at Ksar Akil and other Near Eastern sites has therefore been raised repeatedly in the earlier literature, despite its apparent rejection by many of the later workers in this region (see also Mellars and Tixier 1989).

Interestingly, all of these observations on the early Upper Palaeolithic sequence at Ksar Akil and other Near Eastern sites could in fact be seen to harmonize fairly closely with the recent arguments advanced by Kozlowski (2004, 2005) concerning the apparent evolution of Aurignacian technology within the Balkan region. If, as Kozlowski argues, the initial phase of the Upper Palaeolithic sequence in the Balkans (as represented by the so-called "Transitional" industry recovered from Temnata TDII layer 6) does in fact derive from the dispersal of basically Emiran populations from the Near Eastern region, then one could potentially see the overall pattern of technological development within both the Balkans and the northern Levantine areas as following a broadly similar pattern. How far this would imply continuing demographic or social exchanges between the two regions is an interesting point for speculation, which is currently hampered by the virtual lack at present of well documented and fully published early Upper Palaeolithic sites from the intervening region of western Turkey (Kozlowski and Otte 2000). But in any event the evidence from both the Bulgarian sites and the Near Eastern sites could be seen in several important respects as reinforcing each other, in suggesting an original source area for the ensuing "classic" Aurignacian technologies at some point within this broader southeast European /Near Eastern zone. As Kozlowski (2004) has pointed out, the recent suggestion by Zilhão and d'Errico (2003b, 344–5) that the formation of the classic European Aurignacian could represent an almost "instantaneous" event at ca. 36,500 BP (with the sudden emergence of a range of distinctive new stone tool forms, the idiosyncratic split-base points and other bone types, and the explosion of personal ornaments) is perhaps not the most economical hypothesis, from the evidence at present to hand.

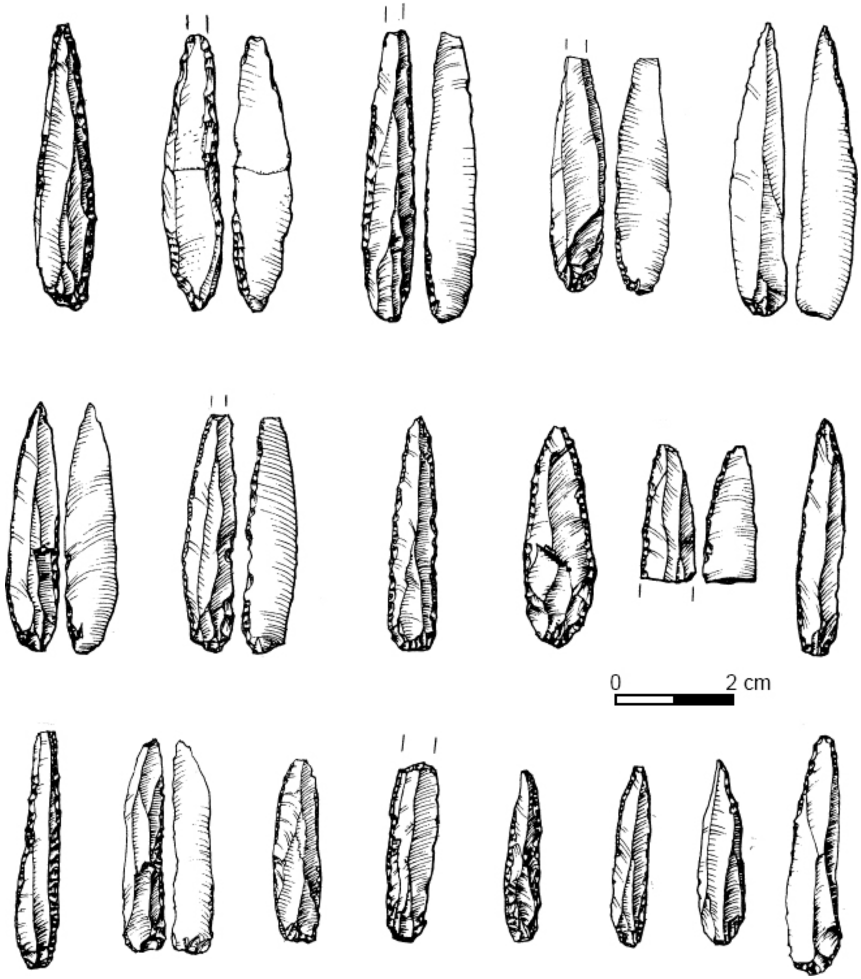

Figure 18.5. Retouched bladelets from levels 9–11 at Ksar Akil (Lebanon), showing a range of typical "El Wad" (i.e. "Font-Yves") points and related forms, many with inverse or alternate retouch on the dorsal and ventral faces. The pieces derive from levels immediately underlying the typical "Levantine Aurignacian" industries from levels 7 and 8 at Ksar Akil. After Bergman (1987).

There is one final aspect of the early Upper Palaeolithic sequence in the Near East which has a potentially equally crucial bearing on the overall patterns of dispersal of early modern populations across Europe. This relates to the origins of what has generally been described in the earlier literature under the heading of

"Mediterranean Proto-Aurignacian" technologies – or what I would now prefer to designate as "Fumanian" industries (Mellars 2003, 2006). As noted earlier, these are distributed mainly along the Mediterranean coastline of Europe, extending from at least north-eastern Italy, via Mediterranean France and the Pyrenees, to the Atlantic coast of northwestern Spain, and are characterized by high frequencies of small, lightly retouched bladelet forms of the so-called "lamelle Dufour" and more sharply pointed "Font Yves" types (Figure 18.4) (Bon 2002). To judge from the existing publications these generally show relatively few if any classic Aurignacian forms (i.e. nosed and carinated scrapers and heavily edge-retouched Aurignacian blades) and are clearly distinct from the classic, early Aurignacian technologies distributed mainly in the areas further to the north and west – though in fact the two technologies do overlap to some extent in both southern France and southern Austria, where the bladelet industries sometimes underlie industries with split-base bone/antler points (Bon 2002). The origin of these Fumanian bladelet technologies has never been clearly identified. The industries clearly appear as an abrupt break with the immediately preceding Mousterian industries along the Mediterranean coast (as for example at the Grotta Fumane and Riparo Mochi in northern Italy and Cueva Morin in Northern Spain) and are generally assumed to represent a dispersal of new populations across this region from further to the east (Djindjian 1993; Kozlowski and Otte 2000; Kuhn and Bietti 2000) The question, then, is exactly where, in these more eastern regions, might one look for an origin of these highly distinctive bladelet technologies?

The most probable answer, in my view, lies once again within the Near Eastern region (Mellars 2004). Two observations in particular are central to this suggestion. First, as noted above, it is now clear that many of the industries which directly underlie the classic (flake-based) "Levantine Aurignacian" technologies within the Near Eastern region do in fact include high frequencies of these small retouched bladelet forms, which fall into the same two broad categories of large "Dufour" forms (often shaped by means of inverse retouch on the ventral as opposed to the dorsal faces of the bladelets) and more sharply pointed "Font Yves" or "El Wad" forms. These bladelet types are particularly frequent in the so-called "Levantine Aurignacian B" assemblages from levels 9–11 at Ksar Akil (Figure 18.5, Bergman 1981, 1987), and occur in a similar stratigraphic position at several other Israeli sites such as Kebara, El Wad and elsewhere (Garrod 1953; Ronen 1976; Bar-Yosef *et al.* 1996). Equally if not more relevant in this context is the industry excavated by Marks from the open-air site of Boker A in the Negev desert of southern Israel (Monigal 2003). This assemblage is massively dominated by these retouched bladelet forms, of both the larger Dufour and pointed Font Yves/El Wad types, and which are similarly shaped in many cases by retouch on the ventral as opposed to dorsal faces (Figure 18.6). At Boker A and elsewhere these bladelets were produced from high-angle bladelet cores apparently closely similar to those documented in the European Mediterranean bladelet assemblages, and are again associated with end scrapers, burins and other characteristically Upper Palaeolithic forms, which could rarely if ever be described as classic Aurignacian forms (Monigal 2003). Finally, there are strong indications that the eastern bladelet technologies are either of the same age or slightly earlier than the similar bladelet industries on the Mediterranean coast. From Boker A there is a radiocarbon date of 37,920 + 2810 BP (which was said by the laboratory most probably to indicate a true radiocarbon age of ca. 39,000 BP: Marks 1993a, 15) while the analogous bladelet industries from levels 9–11 in the Ksar Akil sequence must date from a broadly similar age – estimated on the basis of extrapolated age estimates from radiocarbon measurements of the overlying levels at between 35,000 and 38,000 BP (Mellars and Tixier 1989). Still further to the east, broadly similar industries appear to be represented at the so-called "Baradostian" sites such as Warwasi, Yafteh and Shanidar in Iran and Iraq, which Dibble and Olszewski (1994) have described as representing a "Zagros Aurignacian", and which again appear to date within the range of ca. 36,000–40,000 BP (Hole and Flannery 1967; Olszewski 1999; Bar-Yosef 2000; Otte and Kozlowski 2004; Otte, pers. comm. 2005). By comparison, the most reliable radiocarbon dates for the analogous bladelet industries along the Mediterranean coast and in northern Spain seem to lie within the range from ca. 38,000 to 36,000 BP (as for example at Fumane, El Paina, Isturitz and Cueva Morin) (Bon 2002; Maillo-Fernandez *et al.* 2001; Normand and Turq 2005). I would suggest therefore that these Near Eastern bladelet technologies could well represent the immediate scource of the highly distinctive Fumanian/Proto-Aurignacian industries along the Mediterranean coastline of Europe, and reflect the dispersal of new populations across this region which was largely if not entirely separate from that reflected by the dispersal of the "classic" Aurignacian technologies via the Danube valley and subsequently into the northern and western zones of Europe (Mellars 2003, 2004; see also Kozlowski and Otte 2000; Conard and Bolus 2003) (Figure 18.2). The lack of these industries from the intervening zone of southern Turkey represents an obvious gap in this geographical distribution, but one which can hardly be taken too seriously in view of our virtual ignorance at present of early Upper Palaeolithic technologies in most parts of Turkey (Kozlowski and Otte 2000).

One interesting implication of this scenario is that the appearance of so-called "Aurignacian-like" technologies within the classic southwestern French region was probably a two-phase phenomenon, reflected by the presence of both the "classic" early Aurignacian technologies at sites such as Abri Castanet, Abri Blanchard, La Ferrassie and Abri Pataud, and the presence in at least one site (Le Piage layer K, in the Lot region) of typically, Mediterranean-style "Fumanian" bladelet technologies. The industry from layer K at Le Piage (currently under excavation by a team led by J.-G. Bordes and F. Le Brun-Ricalens) seems to be in most if not all respects closely similar to those from sites such as Grotta Fumane, Riparo Mochi, L'Arbreda and elsewhere on the Mediterranean coast (Champagne and Espitalié 1981; Bon 2002). By contrast, the classic "Aurignacian I" industries from sites such as Abri Castanet, La Ferrassie and Abri Pataud (layers 11–14) show much closer analogies to industries from southern Germany and northern Austria, such as das Geissenklosterle, Vogelherd and Willendorf II layer 3 – with a number of radiocarbon dates significantly earlier than those in the French sites (i.e. extending back to ca. 37–39,000 BP at both das Geissenklosterle and Willendorf, as compared to at most 35–36,000 BP in western France (Mellars 2000; Bon 2002; Conard and Bolus 2003; Haeserts and Teyssandier 2003). As further support for this model one might also note the occurrence of many worked ivory artefacts in some of the French sites – such as the ivory basket-shaped beads from Abri Castanet and elsewhere, the curious curved ivory "bandeaux" forms from the Abri Blanchard, Abri Castanet and La Ferrassie, and the flattened perforated ivory "baton" form from layer 11 at the Abri Pataud (Leroy-Prost 1975; Brooks 1995, Figure 18.7:4), strongly reminiscent of some of the perforated ivory artefacts from Vogelherd and das Geissenklosterle in southern Germany (Hahn 1977, 1988; Conard and Bolus 2003) (see Figure 18.7). The recent excavations at Geissenklosterle and elsewhere have shown that the large-scale working of mammoth ivory was a major features of these German early Aurignacian sites (Hahn 1988; Conard and Bolus 2003). Equally if not more significant is the fact that the French Aurignacian I industries seem to appear in this region at precisely the time when we know that climatic conditions were becoming much colder, associated with the period of Heinrich Event 4 in the deep-sea core climatic records (Mellars 1996, 1998; d'Errico and Sanchez-Goñi 2003). A movement from central Europe directly towards the west and south at this time would seem to be largely predictable in climatic and ecological terms, if only to avoid the onset of extremely severe winters in the more continental regions of central Europe (van Andel and Davies 2003; Gravina *et al.* 2005). According to this model, the apparent movement northwards of the Mediterranean bladelet industries into southwestern France would be likely to have occurred shortly before this time – as the presence of the typical bladelet industry from Le Piage layer K, immediately underlying the typically Aurignacian I industries from levels G–J at this site would strongly suggest (Champagne and Espitalié 1981; Bon 2002). The new excavations currently in progress at Le Piage, as well as those at Isturitz in the western Pyrenees (Normand and Turq 2005), will hopefully shed further light on this question.

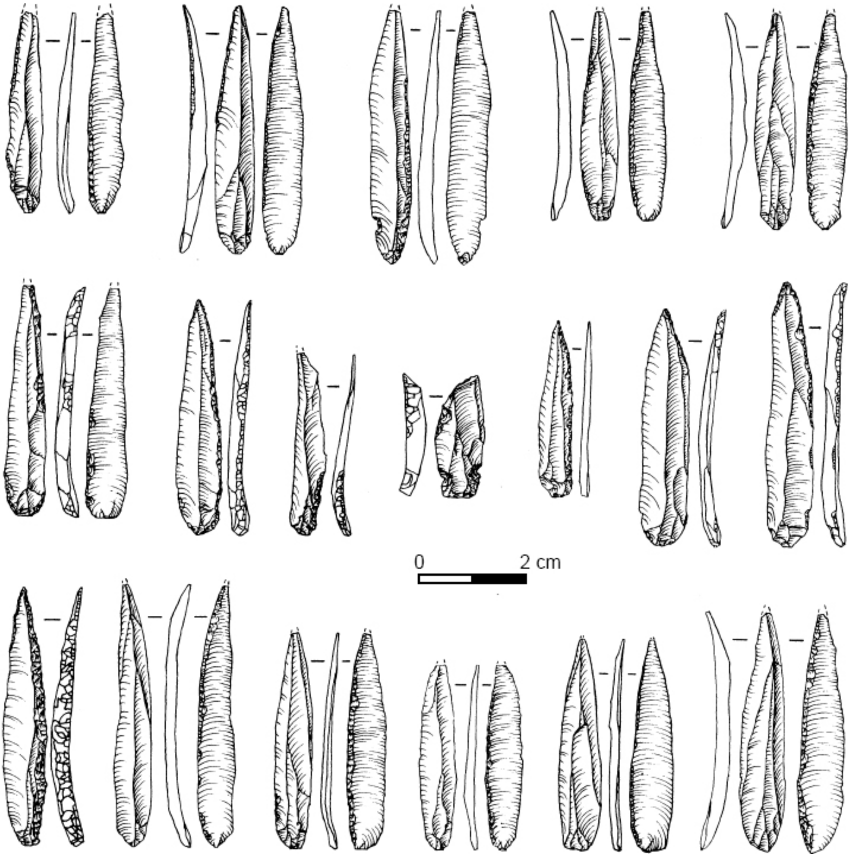

Figure 18.6. Retouched bladelets from the site of Boker A in the Negev desert (southern Israel) showing a range of inversely retouched "El Wad points" and related forms, closely similar to those from levels 9–11 at Ksar Akil (see Figure 18.5). The site is radiocarbon dated to ca. 38–39,000 BP. After Marks (1993b).

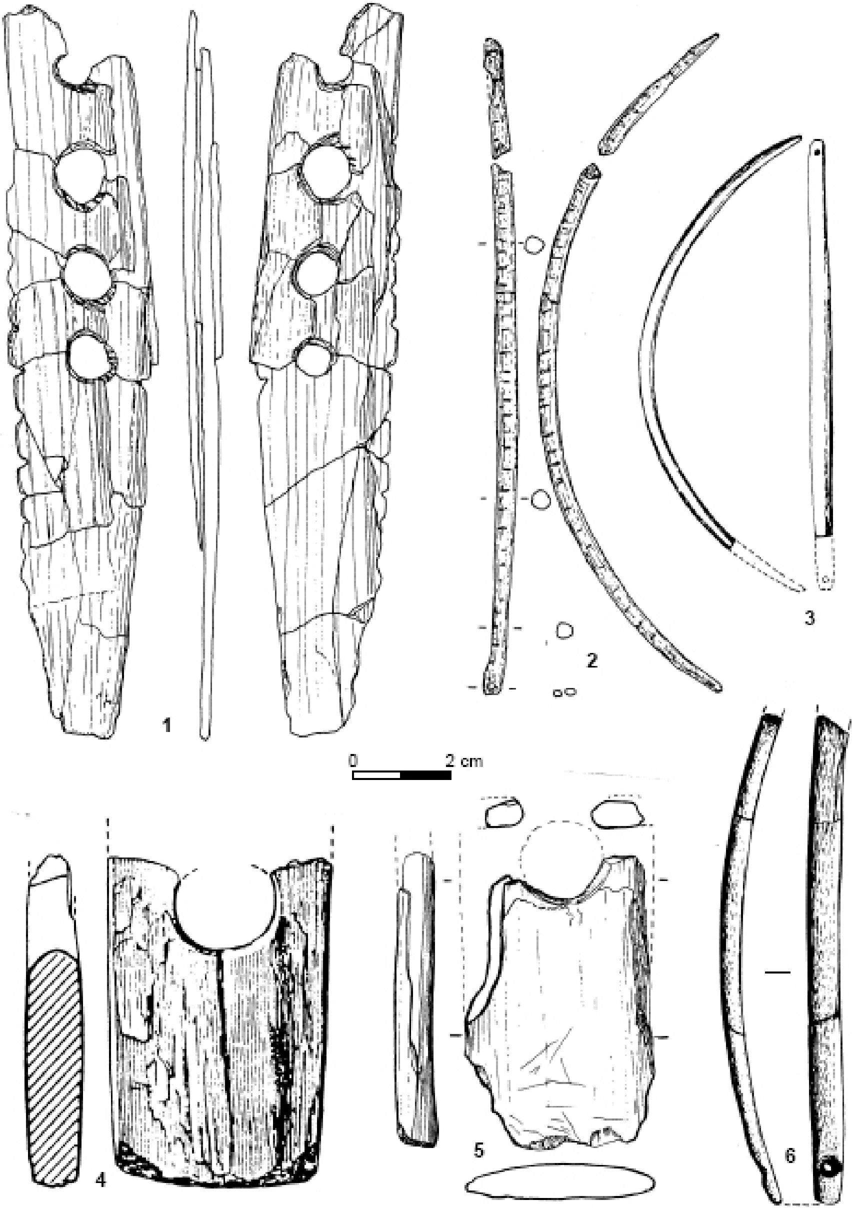

Figure 18.7. Early Aurignacian mammoth ivory artefacts from sites in southern Germany and southwest France. Nos. 1,2 Das Geissenklösterle layer AHII, 3 Abri Castanet, 4 Abri Pataud layer 11, 5 Wildscheuer layer III, 9 Abri Blanchard. After Leroy-Prost 1975; Hahn 1977, 1988; Brooks 1995.

The Aurignacian and the dispersal of anatomically modern

humans

So what relevance – if any – does the "Aurignacian" have for the dispersal of anatomically and behaviourally modern populations across Europe? The answer in my view may be fairly straightforward. The most critical single discovery is the so-called "Egbert" skeleton from Ksar Akil, excavated by Ewing from close to the back wall of the shelter and clearly embedded in brechiated deposits within level 17 of his stratigraphy (Ewing 1947; Bergman 1987). According to the detailed analysis by Bergman and Stringer (1989) this is unquestionably a fully modern human (in both cranial and postcranial terms), probably of around 7 years in age. The skeleton was in the form of a burial (apparently associated with parts of a second skeleton), associated with what would now be termed a typical "Ahmarian" industry in level 17 (Bar-Yosef 2000), and overlain by the full sequence of at least 7 metres of succeeding "Levantine Aurignacian" industries in levels 13–7. In radiocarbon terms the skeleton must date from at least 40–42,000 BP, and conceivably from as early as 45,000 BP (Mellars and Tixier 1989). This find alone is sufficient to demonstrate that fully anatomically modern populations were present in the Near Eastern region well before the appearance of the long sequence of ensuing Aurignacian-like technologies.

Although finds of human skeletal remains in direct association with Aurignacian technologies are notoriously scarce in all parts of Europe, the available finds are entirely consistent with the conclusion that these industries were similarly associated with characteristically modern populations (Churchill and Smith 2000; Mellars 2004). The best dated association between Aurignacian industries and human remains are those of at least five individuals from the Mladec cave in the Czech Republic, recently dated by direct radiocarbon measurements on the remains themselves to at least 31–32,000 BP (Wild *et al.* 2005), and perhaps closer to 34–35,000 BP on the basis of dating of closely associated stalagmite formations (Svoboda *et al.* 2002). Further to the west there is a typically modern (if very robust) human jaw from the basal Aurignacian level at Les Rois in the Charente (Gambier 1989), which on the basis of dating of similar industries in other southwest French sites must similarly date in the region of 32–34,000 BP (Mellars 2004). Bailey and Hublin (2005) have recently argued that the series of human teeth recovered from the early Aurignacian levels at Brassempouy in the Pyrenees are unmistakably anatomically modern (as opposed to Neanderthal) on the basis of their distinctive cusp patterns, with associated ^{14}C measurements of around 34,000 BP (Henry-Gambier *et al.* 2004). And Churchill and Smith (2000) have argued that the fragmentary human jaw and other remains recovered from the much earlier Bacho Kirian levels (ca. 40–43,000 BP) at Bacho Kiro are most probably of anatomically modern rather than Neanderthal in form (see also Kozlowski 2005). Finally, we have the recent find of at least three robust but typically anatomically modern individuals from the Pestera cu Oase cave in Romania, dated directly on the bone themselves to ca. 35–36,000 BP. Although not associated directly with archaeological material, these finds are entirely within both the time range and the geographical province of the earlier Aurignacian in southeastern Europe.

Unfortunately we have at present no human remains associated directly with the Proto-Aurignacian/Fumanian bladelet industries from the Mediterranean coastal zone, with the exception of the enigmatic "pseudomorph" human burial excavated in association with the typically bladelet-dominated industry at Cueva Morin on the adjacent Cantabrian coast (Gonzalez Echegaray and Freeman 1971, 1978). If this is indeed the skeleton of an anatomically modern individual, as the large size of the skeleton (estimated at ca. 185 cm) would suggest, then we can presumably associate these technologies also with anatomically modern populations. This could be supported further by the arguments outlined above for the apparent origins of these bladelet technologies within the earlier part of the long "Levantine Aurignacian" succession at Ksar Akil and elsewhere, closely overlying the anatomically modern Egbert skeleton from the immediately preceding Ahmarian levels (Bergman 1987; Bergman and Stringer 1989). As I have discussed elsewhere (Mellars 2004; see also Djindjian 1993; Bar-Yosef 2000; Kozlowski and Otte 2000), all of these observations would tend to support the model of two separate routes of dispersal of anatomically modern populations across Europe, one primarily along the Danube valley associated wih the dispersal of the "classic" Aurignacian, and the other along the Mediterranean coast represented by the bladelet dominated Fumanian industries, and both deriving from the hypothetically ancestral Emiran and Ahmarian populations within the east Mediterranean Levantine region (Figure 18.2). Whether the origins of these populations should be traced even further to the east – conceivably into the Zagros region, or even Central Asia, as Kozlowski and Otte (2000; Otte and Kozlowski 2004) have suggested, is at present one of the most critical questions in current studies into modern human origins in Eurasia.

Dispersal patterns of modern humans in Europe

From the various patterns discussed above we can now perhaps begin to reconstruct a more sophisticated model for the overall pattern of dispersal of anatomically and behaviourally modern populations across Europe. If we focus on what what we might call the "northern" or "Danubian" route discussed above, we can perhaps envisage an essentially two-phase dispersal process commencing initially in the Near East with the development of the Emiran and immediately ensuing Ahmarian technologies, which had clearly emerged in this region by at least 45,000–47,000 BP (on the basis of the dates for Boker Tachtit and Ksar Akil) and which could well extend back to around 50,000 BP (Mellars and Tixier 1989; Bar-Yosef 2000; Mellars 2003). We know from the Egbert skeleton from Ksar Akil that at least the later stages of this sequence (from ca. 43,000 BP) were associated with typically anatomically modern populations (Bergman and Stringer 1989). According to the evidence advanced by Kozlowski (2004), Bar-Yosef (2000), Tostevin (2003), Svoboda (2003) and others, these populations seem to have expanded – via Turkey – to southeastern Europe by around 43,000 BP, as represented by the Bacho Kirian levels at Bacho Kiro, the similar levels at Temnata, and the apparently related Bohunician technologies from the Czech Republic (Svoboda and Bar-Yosef 2003; Kozlowski 2004, 2005). Within southeastern Europe itself – and perhaps also in the adjacent areas of the Levant, as reflected in the Ksar Akil sequence – it would seem that these technologies developed a number of more explicitly "classic" Aurignacian features, in the form of typical carinated and nosed scrapers and edge-retouched Aurignacian-like blades (Kozlowski 1999, 2004, 2005).

A second stage in the dispersal process would seem to have taken these more "classic" Aurignacian technologies westwards along the Danube valley into central Europe, where they are best represented at sites such as Willendorf in lower

Austria and das Geissenklosterle and Keilberg Kirche in southwest Germany, with radiocarbon dates centering on ca. 37–39,000 BP (Uthmeier 1996; Conard and Bolus 2003; Haesaerts and Teyssandier 2003). The final dispersal of the classic Aurignacian technologies into western France is currently dated to around 35–37,000 BP, as at the sites of Chatelperron, Abri Castanet, La Ferrassie, La Rochette and Tuto du Camalhot (Mellars 2000; Bon 2002; Gravina *et al.* 2005) (see Figure 18.8).

Two further aspects of this demographic and technological dispersal scenario are of particular interest here. In the first place there are strong reasons for thinking that the major dispersal northwards and westwards of the early Aurignacian populations was associated closely with a major episode of climatic warming, generally referred to as either the "Hengelo" interstadial, or "GIS12" in the Greenland ice cores (Mellars 1996, 1998; Shackleton *et al.* 2004). This was clearly a major event in climatic terms, marked by a temperature rise of at least 5–8°C, and apparently persisting for a duration of at least 3000 years (Shackleton *et al.* 2004). In vegetational terms, this was marked by a replacement of essentially open, tundra or steppe-like vegetation in western Europe by at least partially wooded conditions (van der Hammen 1995; Huntley and Allen. 2003). For populations originating in the warmer and more forested regions of southeastern Europe, this would inevitably have made a process of demographic dispersal towards the north and west much easier to achieve, perhaps amounting to little more than what I have referred to in earlier papers as "surfing the ecological tide" (Mellars 1996, 1998). In other words, a major population dispersal westwards at this time would be not merely plausible, but arguably largely predictable in ecological and demographic terms.

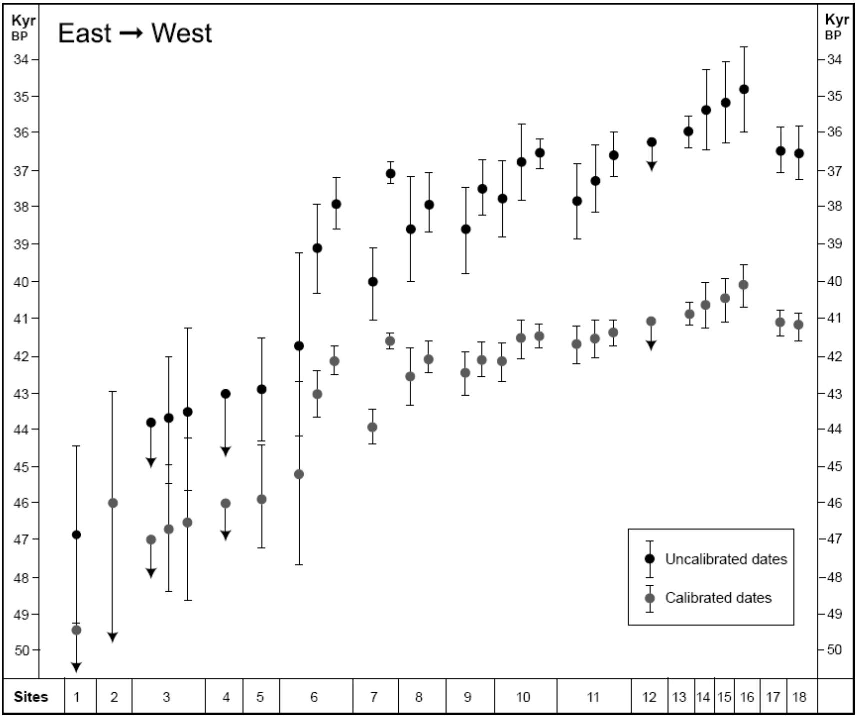

Figure 18.8. Radiocarbon dates for early Aurignacian, "Proto-Aurignacian" and apparently ancestral Bacho Kirian, Bohunician, Ahmarian and Emiran technologies across Europe and the Near East. The sites are arranged by regions from west to east. The dates are plotted in terms of the original, uncalibrated radiocarbon measurements (upper) and the calibrated versions of the dates (lower), based on the recently published calibration curves from the Cariaco Basin and elsewhere. Note that only the oldest dates from each region are plotted, on the assumption that these are likely to be least affected by contamination by more recent, intrusive carbon (Bronk Ramsey et al. 2004). The sites plotted are as follows: 1 Boker Tachtit (Israel), 2 Ksar Akil (Lebanon), 3 Kebara (Israel), 4 Bacho Kiro (Bulgaria), 5 Bohunice (Czech Republic), 6 Willendorf II (Austria), 7 Grotta Fumane (Italy), 7 El Paina (Italy), 9 Keilberg Kirche (Germany), 10 Geissenklöstlerle (Germany), 11 Abric Romaní (Spain), 12 Chatelperron (France), 13 La Rochette (France), 14 Abri Caminade (France), 15 Abri Castanet (France), 16 Roc de Combe (France), 17 Isturitz (France), 18 Cueva Morîn (Spain). The currrently controversial dates from El Castillo and l'Arbreda (Zilhão and d'Errico 2003b) have been omitted.

The second even more significant pattern which has emerged from recent research is that when we translate the available "raw" radiocarbon dates into calibrated, calendrical terms, this pushes the absolute age of the main Aurignacian dispersal across Europe back by several thousand years (Mellars 2005). Until recently, the exact pattern of divergence of radiocarbon dates from true calendar years within the 30,000–40,000 year time range remained highly controversial, with the suggestion of potentially massive and erratic oscillations in the ^{14}C content of the atmosphere which could have caused equally erratic fluctuations – and even major reversals – in radiocarbon age measurements by up to 8,000 years (Kitagawa and van der Plicht 1998). Happily, two new and tightly constrained calibration curves over this time range have been published during the past 18 months, based on the radiocarbon dating of a long sequence of deep-sea sediments from the Cariaco basin near Venezuela, and a series of directly paired ^{14}C and high-resolution uranium/thorium measurements on fossil coral samples from the Barbados and elsewhere. These show unambiguously that the erratic oscillations in the radiocarbon time scale suggested from some earlier calibration curves (such as those from Lake Suigetsu in Japan, and the dating of some cave stalgmite formations in the Bahamas) were spurious (Kitagawa and van der Plicht 1998). They also show that the rapid increase in the ^{14}C content of the atmosphere over the 30,000–40,000 year period means that the relative precision and resolution of radiocarbon dating over this time range is actually almost twice as great as that in other, adjacent parts of the age scale – since a measured difference of 2000 years in radiocarbon measurements over this time range translates into an actual difference of only around 1500 years in absolute, calendrical terms.

If we apply this new calibration curve to the available dates for the earliest dated occurrences of Aurignacian and related technologies across Europe, this produces the pattern shown in Figure 18.8. Owing to the shape of the calibration curve, we can now see that the dispersal of Aurignacian technologies across central and western Europe – from the Balkans to western France – occupies an actual period of only around 3000 years (from ca. 44000 to 41,000 cal. BP) as compared to a period of 5000 years (ca. 40,000 to 35,000 BP) in terms of the original, uncalibrated, radiocarbon dates (Figure 18.8). Evidently, the dispersal of anatomically modern populations across eastern, central and western Europe was a more rapid process than previously envisaged. None of this is surprising, since hunter-gatherers are inherently mobile in their habits, and the demographic dispersal from east to west would have been greatly facilitated by the major climatic amelioration around this time, as discussed above. Interestingly, this shows that the dispersal of early modern populations along the Danube valley route was similar to that of the subsequent Neolithic colonists along essentially the same geographical route. From the available dates it would seem that the broadly synchronous dispersal of the bladelet-dominated (Fumanian/Proto-Aurignacian) technologies along the Mediterranean coastal zone was an equally rapid event, reaching northeastern Italy by ca. 38,000 BP and northwestern Spain by at least 36,500 BP in uncalibrated radiocarbon terms (Maillo-Fernandez *et al.* 2001; Bon 2002) – or ca. 41,000 BP in calibrated, calendar years.

When seen in these terms, the striking uniformities in many aspects of the "classic" Aurignacian technologies extending from the Atlantic coast of western Europe to at least the northern parts of the Near East become easier to understand. Even so it would clearly be unrealistic to expect to find identical technological patterns across this region. If we assume that any process of population dispersal would inevitably be a progressive, multi-stage phenomenon, then we would expect to observe not only the effects of technological and cultural change over time during the dispersal process but also a process of progressive adaptation to the changing environments across central and western Europe. This would be combined with the cumulative effects of repeated cultural and technological "founder effects" as relatively small population units progressively expanded from east to west (cf. Eswaran 2002). These effects would subsequently become amplified as the individual population units gradually "settled into" the different geographical provinces across Europe, and developed their own particular trajectories of cultural and technological change (Conard and Bolus 2003; Mellars 2006). To find that the early Aurignacian populations of southern Germany developed significantly different styles of figurative and abstract art, and varying patterns of personal ornaments, from those found in western France should hardly come as any surprise (Hahn 1977; Conard and Bolus 2003; Mellars 2006).

Exchange

Finally, it is interesting to ask how far we can detect any patterns of cultural or technological exchange between the earliest dispersing populations of modern humans across the different regions of Europe. Much of the essential research in this area still remains to be done, although there are already some hints of potentially significant patterns. Within the southwestern French region, for example, we can already document what appear to be some very clear patterns of exchange of perforated bead forms manufactured from steatite and other soft stones between the Perigord region and sites on the northern flanks of the Pyrenees (as at Isturitz and Brassempouy) some 300 km to the south (White 2001; Bon 2002). Equally if not more striking is the presence in many of the earliest southwest French sites of various species of perforated marine shells, which must have originated from the Mediterranean coast of southeastern France (Taborin 1993a, b). Since identical forms of perforated shell beads occur abundantly in the typical Fumanian bladelet assemblages along the French and Italian Mediterranean coast (Kuhn and Stiner 1998; Bon 2002) it is tempting to suggest that these could reflect direct social and economic exchanges between these two populations. Clearly, more research into these questions is urgently needed. But it is already clear that when some of the long-standing historical confusions over the various concepts of “Aurignacian” technology have been cleared up, a fairly robust pattern of early modern human dispersal across Europe is, hopefully, beginning to emerge.

Acknowledgements

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